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June 28, 1934

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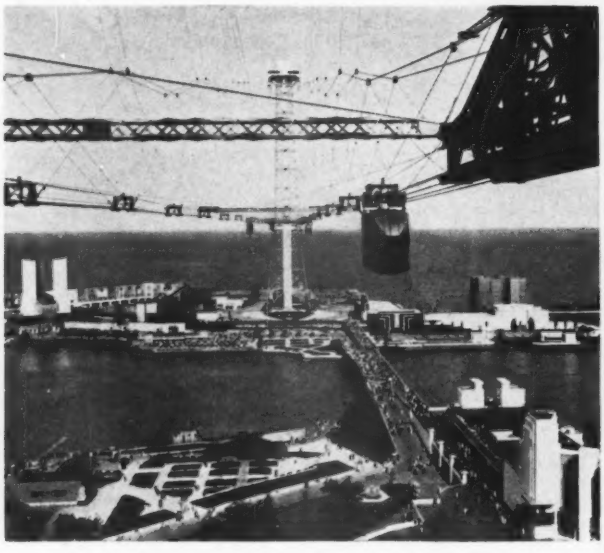
Engineering News-Record

Hammerhead cranes, new to suspension-bridge erection, topped out this west tower of the San Francisco-Oakland Bridge on June 15

The SKYRIDE



foretells change

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In the News:

WHO first conceived the idea of dividing opposing streams of traffic on a highway through the simple expedient of painting a white line on the pavement? The Chamber of Commerce of Fresno County, California, would like to know, as it wants to honor the person who made such a notable contribution to the safety of the traveling public.

SUBSTITUTION of engineers for firemen on fire inspection in New York City has revealed that the antiquated Metropolitan Opera House violates many of the city's fire laws. Half a million dollars is to be spent in changes to make the old building comply with the law. The engineers, fresh to the job, disregarded the halo of respectability that has made inspection by the fire department a perfunctory operation.

A WHITE-COLLAR cooperative employment movement has been inaugurated in Cleveland. Engineers, numerically, head the list of those who seek to aid each other in finding jobs.

CONTRACT for the first 30 miles of the All-American Canal has been let to the same combination of firms that is building the Madden Dam in Panama—Callahan, Gunther and Shirley of St. Louis and Dallas. This combination was awarded sections 1 to 6, inclusive, for $4,859,588. Section 7, involving heavy rock work included within the limits of section 4, was awarded to the Griffith Co. of Los Angeles for $226,800. The main canal will be 80 miles long, and the Coachella branch will extend for 130 miles. Present contracts do not include special lining or siphon structures.

A SPECIAL COMMITTEE will choose the route of the proposed scenic highway between the Shenandoah and Great Smoky Mountain national parks, as the result of a dispute between North Carolina and Tennessee over the location of the western portion of the route. A PWA allotment of $4,000,000 provides starting funds for the $16,000,000 project.

The $200,000,000 federal-aid highway fund for the fiscal year beginnin, July 1 has been tentatively allocated an ong the states.

CONGRESS appropriated $1,000,000 o enable the United States to cooperate ith the several governments of the Pa.. American Union in connection with the proposed Inter-American Highway, and the Hayden-Cartwright Road Act authorized the expenditure of $75,000 for reconnaissance surveys and estimates. Where or how the money is to be spent has not been made public.

In This Issue:

THE FIRST of two articles on new developments in revetment construction is published in this issue. It relates to the fabrication of very large sheets of reinforced asphalt mat on a specially designed floating plant at the site on which it is to be laid. The use of asphalt in revetment work is a new departure. It is the outcome of extensive research to find suitable low-cost materials and to develop the fabricating plant.

FURTHER LIGHT on the relation between wheel loads and slab thickness in concrete highway design is given in the study of the effect of the area of tire contact on slab stresses.

DROUGHT may have effects of interest to engineers as well as to agriculturists if of long duration or if it follows a time of abnormally low runoff. The recent drought in the North Central States has such interest. Some of the immediately available information upon its engineering aspects is published in this issue. Other information will be given in a subsequent issue.

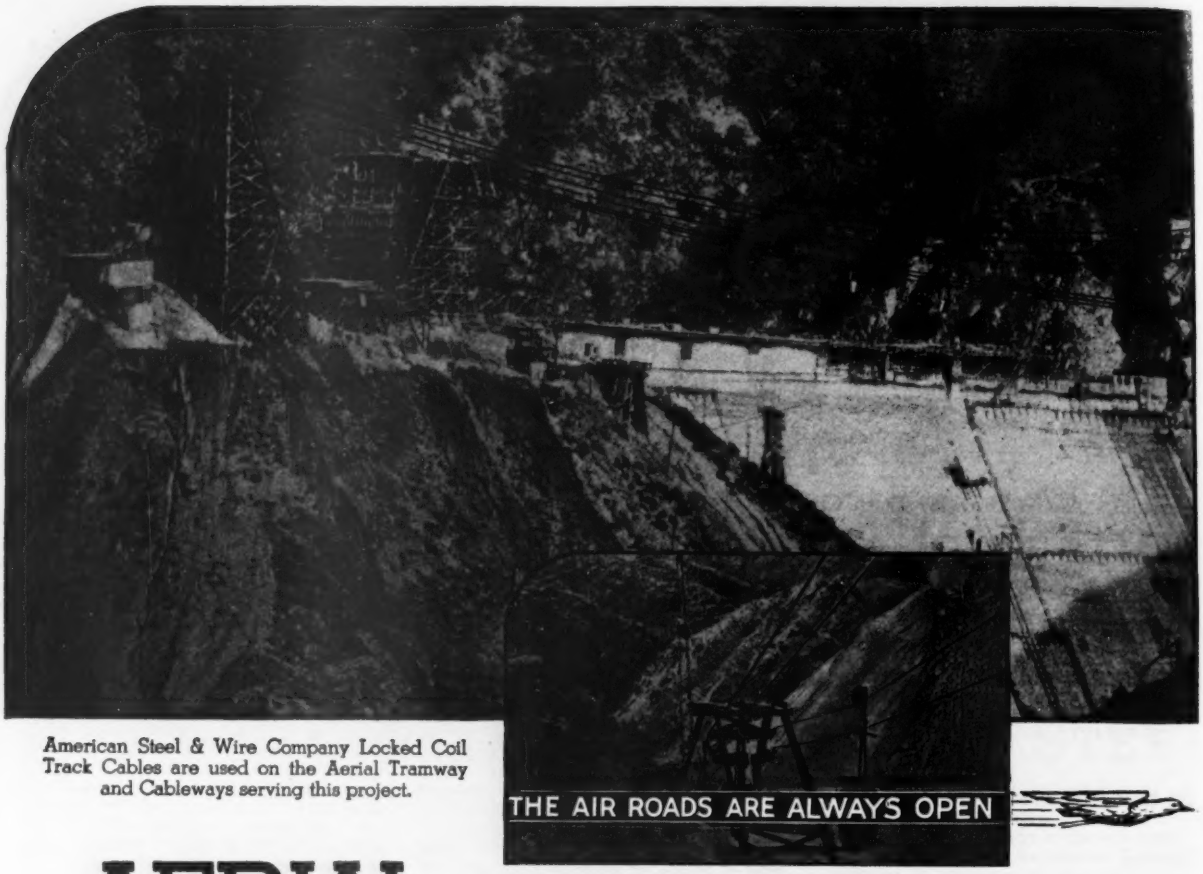
THE CUTTING DOWN of river beds below dams, resulting from the deposition in the reservoir of the normal load of material carried by the river either in suspension or as a bed load, is a matter of concern to engineers both as it affects the security of the dam and as it affects the power plant, when the dam is used to develop power. Information collected by the Bureau of Reclamation in its study of Boulder Dam is summarized in this issue by E. W. Lane. Additional information is given by L. F. Harza, Samuel Shulits and A. M. Shaw.

THE POSSIBLE ECONOMIES to be obtained in bridge construction through careful consideration of details are shown in the new Hilliard Bridge at Ottawa, Ill. Through recognition of the difficult or expensive elements of the fabricator's and erector's work the designers were able to reduce the total cost materially.

THE S.P.E.E. held the largest meeting of its 42 years of existence at Cornell last week. An account in the news pages records some of the trends in engineering education that were outlined, while a three-page report beginning on page 843 reviews the notable two-day conference on the laboratory uses of structural and hydraulic models that preceded the regular meeting.

Index

An index for Volume 112, January-June, 1934, will be published with the issue of July 12, 1934.



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ENGINEERING NEWS-RECORD

New York

June 28, 1934

FIG. 1—ASPHALT MAT being drawn off the fabricating deck of mattress barge after it has been cooled sufficiently to handle. This photograph shows the first "launch" of mattress hanging over the launching apron with its outer end in the river.

Bank-Revetment Developments on the Mississippi River

I—Asphalt Mat Revetment

Field application stage reached in the development of the two new types of revetment—Special plant for fabricating sheet-asphalt mats completed in the New Orleans district

REVETMENT CONSTRUCTION, the protection of banks against attack by the river, has always been one of the major tasks of the Mississippi River Commission. It also has been, and still is, one of the commission's most costly operations. With hundreds of miles of bank subject to more or less vigorous attack and with modern revetment costing on an average more than $300,000 per mile, it is apparent that very large sums are involved. This condition has led to continuing effort on the part of the army engineers charged with the control of the river to increase the effectiveness and decrease the annual cost of bank protection. South of Cairo such bank protection is almost exclusively by some form of revetment.

Beginning with simple forms of brush mats, revetment structures have progressed from the simpler forms to the more elaborate framed willow mats and facine mats of recent year. These types were described in *Engineering News-Record,* May 1, 1930, p. 720, and July 2, 1930, p. 4. Recent years also have seen the development of what were hoped to be more permanent types, articulated concrete-block mats and articulated concrete-slab mats. The two latter types were described in *Engineering News-Record,* Dec. 25, 1930, p. 996 and April 14, 1932, p. 554. With all four types, practice in design and construction have been perfected in both equipment and methods of construction to the point where little if any further reduction in cost appeared possible. Nevertheless, unit costs continued to be high, and a satisfactory degree of permanence was not obtained even with concrete.

In continuation of the study to develop bank revetment that will be made effective and less costly than the types now in common use, tests on two new types have been in progress on the lower Mississippi River for more than a year, as noted in a series of articles entitled "New Plans for the Mississippi," published last year (*ENR,* Aug. 10, p. 166). The work is being carried on by the district engineers, U. S. Army, under the direction of the Mississippi River Commission. In the Second New Orleans Engineer District a full-scale plant for the fabrication of a reinforced-asphalt mat, developed from studies made last year on a small experimental plant, is being put through preliminary tests, and at a dozen points in the Memphis and Vicksburg districts large-scale tests are being made with revetments composed of gravel protected by tetrahedral-shaped concrete blocks. Revetments of the latter type were laid by the Memphis district engineers during December, 1933, followed in January, 1934, by further construction of the same

general type near Greenville, Miss., in the Vicksburg district. Details of the latter operations will be given in a subsequent article; this article relates to the asphalt-mat work in the Second New Orleans district, where the first of this type of mattress is being laid on the west bank of the river, a short distance above New Orleans.

Asphalt mattress revetment

The plant for making and laying asphalt mattresses now being put into service marks the culmination of many months of work on the design of equipment, much of which is new or an adaptation of existing types of equipment to new conditions; and back of the physical work of building a plant that would produce such a mattress on an economical basis are many more months of research and study of materials, some of which may have an effect far beyond the immediate field of river-bank protection. This is especially true of the discovery that loess, the aeolian deposit that caps the non-alluvial bluffs along the lower Mississippi River, makes an asphalt filler superior to and much less costly than the fillers now commonly used.

As noted previously, the high cost and temporary nature of the mattresses long used for bank revetment led, some years ago, to the development of articulated concrete mattresses. These concrete mattresses turned out to be costly to build and have been found to lack permanence, chiefly because of corrosion of the steel ties between the blocks. Substitution of non-corrosive material for the steel used in the ties made the mattresses more expensive. In the search for a still better type of revetment, attention naturally turned toward asphalt. Its permanence is a matter of general recognition; it is waterproof and, consequently, can be counted on to protect reinforcing material bedded in it. Therefore, if a compound could be developed at a reasonable cost that would be flexible enough to stand the stress of launching and sinking and yet strong enough to maintain its shape, it appeared that an ideal revetment material would be obtained.

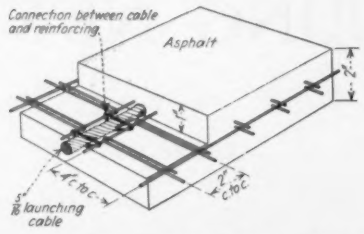


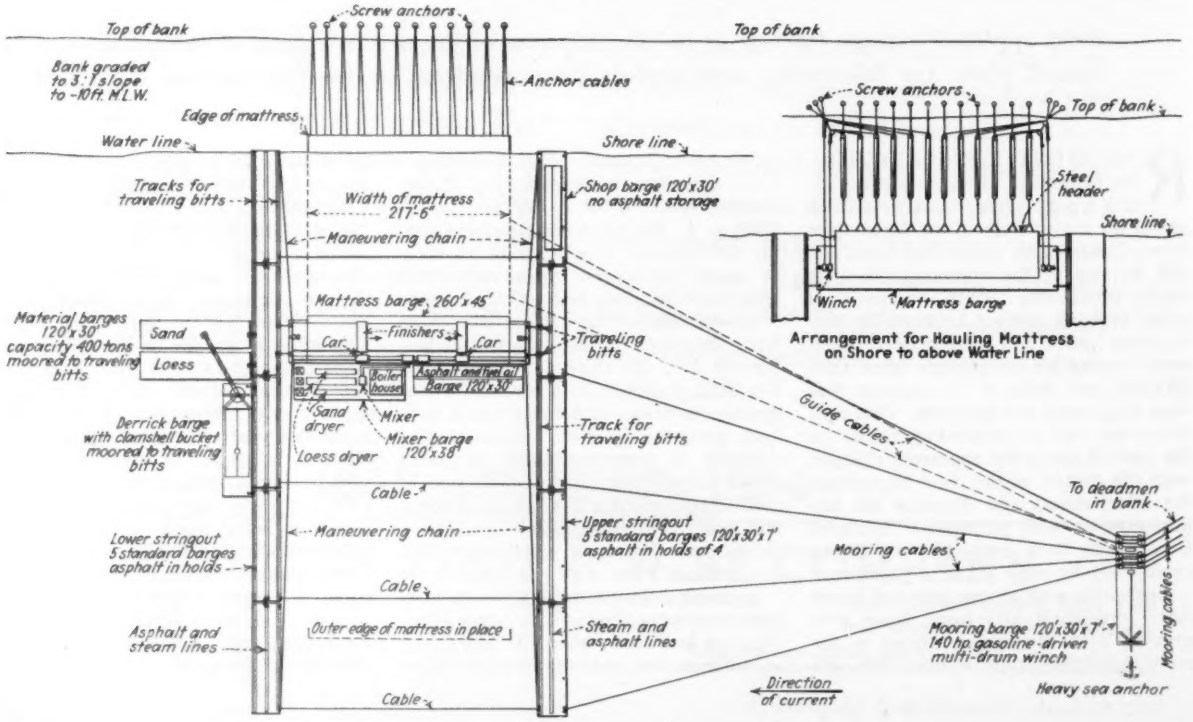
FIG. 2—RELATION of the reinforcing of the asphalt mat to the launching cables running through the mat is shown in this isometric drawing of a section of the mat.

Preliminary research

The research of the army engineers was directed first toward a study of the mineral aggregates required for an asphalt mixture—namely, sand and a filler—with the idea of discovering what materials local to the region were available and determining the suitability of available materials to produce a mixture of the desired character. It was hoped to find materials that could be obtained in large quantities at small expense and with a minimum of processing. For this study nearly 200 samples of sand, silt and non-alluvial soils were collected in the region between New Orleans and Vicksburg. Sand was taken from all river bars of any size between Baton Rouge and Vicksburg, and samples of non-alluvial soils were taken from the many extensive deposits that cap the bluffs of the region. These were graded and classified, and the study of mixtures was begun.

The characteristics of the mixture sought were, strength, flexibility, adhesion, workability, toughness, density (to insure waterproofness) and durability. High strength, consistent with the flexibility required in revetment work, and an adequate bond strength were sought. In addition, the mixture had to be workable, easy to handle as a hot mix, of ready compressibility. Particle sizes, voids and specific gravities of the materials were determined, the effect of hardness of asphalt on the properties of the mixtures was noted, as was the relative resistance to displacement under load, using the standard stability test for asphalt mixtures. Mixtures that appeared to have the required charteristics were further submitted to bend, bond, tensile strength, durability and shear tests. The bend test, the most important of the group and the one that is to be employed as part of the laboratory

FIG. 3—THE FABRICATING PLANT is so arranged that the asphalt mat can be made at the point where it is to be laid. Beginning at the shore, the plant is moved riverward between the lines of "stringout barges" as the mat is fabricated.



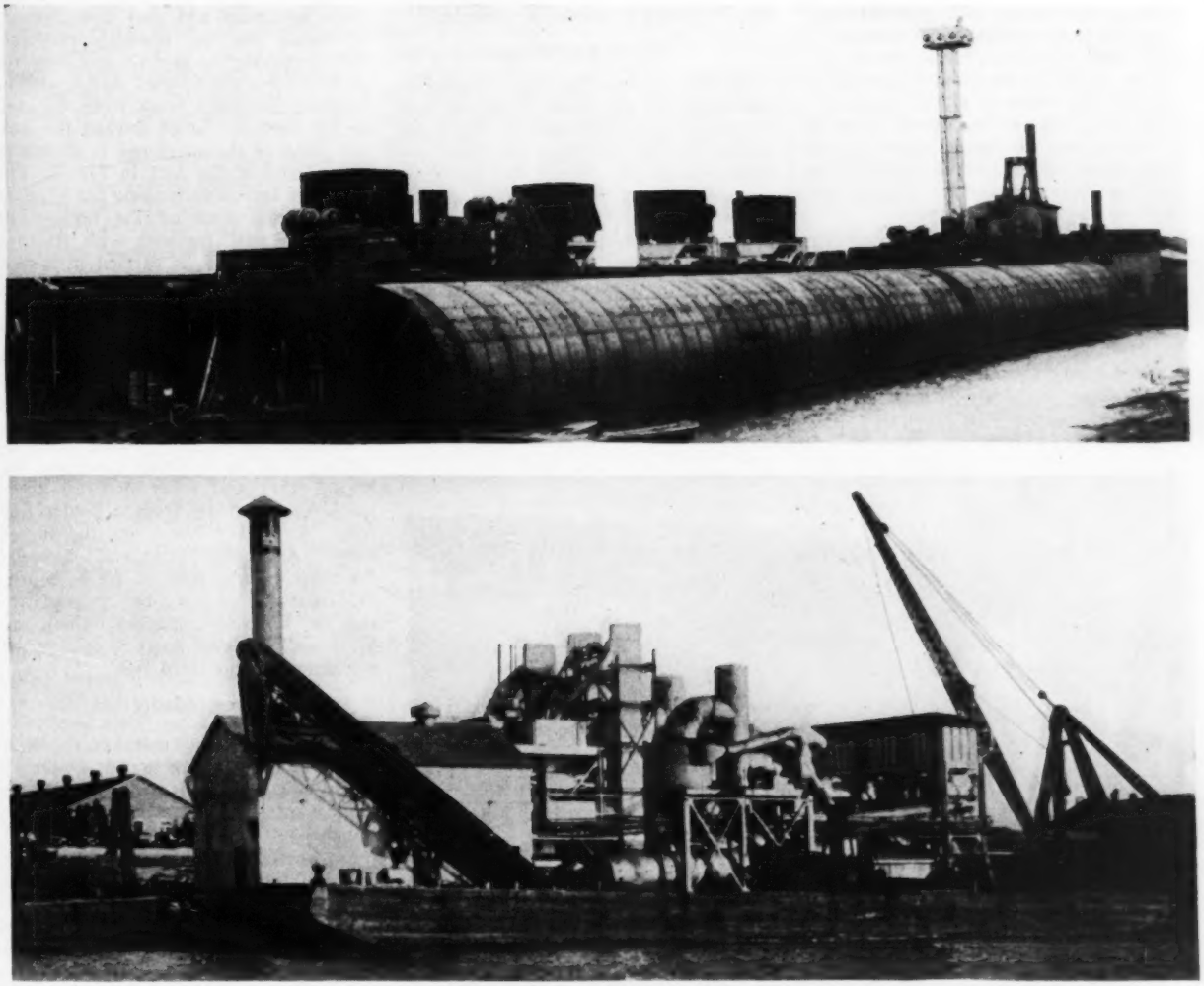


FIG. 4—THE MATTRESS BARGE is shown in the upper view, with the launching apron in the foreground, and below is the barge containing the mixing plant and power house. When in operating position, the mattress barge lies against the side of the mixing barge here shown, the inclined conveyor delivering the asphalt mix to hopper cars on the mattress barge.

control in the revetment plant now being put into service, was made as follows: Specimens 2x3x10 in. in size were subjected to twenty reverse bends on a 48-in. radius, followed by reverse bends on an 18-in. radius to failure. Failure, as termed, was the appearance of a crack, and generally required from ten to fifteen additional reversals on the shorter radius mentioned. In the laboratory control, continuous tests using the standard Hubbard-Field stability tester will be made, and the bend tests will be made at longer intervals, the stability test being indicative of results to be obtained in the bend tests when using mixtures approximating those considered as ideal.

From the tests made it was determined that the most desirable mixture could be produced by using 66 per cent of sandbar sand, 22 per cent loess and 12 per cent asphalt, by weight. The compacted mixture weighs 130 lb. per cu.ft. The supply of both bar sand and loess is practically unlimited, the sand is uniform throughout the region, and the loess (the non-alluvial material from the bluffs) is remarkably uniform and of a fineness surpassing that of portland cement. The tests indicated further that this loess material, frequently dug out and thrown aside in street-paving work, is superior to the rock dust and other fillers now used as such for asphalt paving mixtures.

Asphalt mattress plant

Having determined that a desirable mixture could be obtained at reasonable cost, the development of a commercially practicable plant for fabricating and placing the asphalt-revetment mattress was undertaken. Experiments on a small scale were first conducted in the spring of 1933. A brief summary of these experiments was given in our issue of Aug. 10, 1933, p. 166. The full-sized plant now being put into operation follows out the method there outlined. It is designed to fabricate a reinforced-asphalt mattress of a thickness varying from 2 to 3 in., 217 ft. 6 in. wide and of any desired length up to 575 ft., the latter being frequently required in the Second New Orleans District (*i.e.* Vicksburg to Head of Passes near the mouth of the river). The reinforcing consists of ⅜-in. launching cables spaced at 3-ft. intervals, and of welded wire fabric in continuous lengths 6 ft. wide consisting of No. 12 wires with 2x4-in. mesh, stapled together to form a continuous sheet. The welded mesh is stitched to the launching cables at short intervals with wire staples. The whole reinforcing system (cables and fabric) is embeded in the center of the 2-in. mattress to protect it from corrosion, as shown in the accompanying drawing. During the process of fabricating the mat the reinforcing system is held in this position by means of wire chairs similar to those used to support reinforcing rods in reinforced-concrete floors. The wire mesh has a strength normal to the direction of the launching cables of 2,000 lb. per foot of width.

The layout of the mattress plant is shown in Fig. 3. In a general sense, it follows the layout of concrete-mattress plants, with some modifications due to the different character of the operations employed and the greater width of mattress. Between two parallel lines of

stringout barges the combined mattress casting and laying units operate, moving out from shore as the mattress is cast and launched. Construction proceeds in 30-ft. increments (launches) for the full width of 217 ft. 6 in. It is anticipated that these 30-ft. launches (6,540 sq.ft.) can be fabricated at the rate of at least one an hour when the plant is operating under normal conditions.

As will be noted from the drawing, the asphalt, the one material that might be subject to interruption of supply, is stored in the holds of most of the stringout barges. Including that stored in the hold of the asphalt and fuel-oil barge, there is a capacity of 2,500 tons, or more than sufficient for three weeks' continuous running on a two-shift basis. Steam for heating the asphalt in the barges is supplied by the boiler plant on the mixing barge, which lies to the rear of the mattress barge. Pumps to keep hot asphalt circulating through the supply line to the mixer plant are located on the asphalt and oil barge. Sand and loess are stocked on barges of 400-ton capacity, from which a floating derrick with clamshell fills the hoppers on the mixing barge.

The two principal units of the fabricating plant are the mattress barge, 260x45 ft., and mixer and power-plant barge, 120x38 ft. In position for operation, the mattress barge lies parallel to the shore line between the two lines of stingout barges, and back of it is the mixer barge and the asphalt and fuel-oil barge.

The three barges are locked together and move as a unit. A view of the mattress barge, as seen from the shore, is shown in Fig. 4, and the same figure shows the mixer barge viewed from the side that lies against the mattress barge when in normal operating position.

Mixing operations

The arrangement and the sequence of operations on the mixer barge can best be explained by reference to the lower picture in Fig. 4. Sand and loess are delivered by the derrick to the three elevated bins at the right-hand end of the mixer barge, sand to the two outside bins and loess to the center one. From these bins both materials pass through table feeders and then by belt conveyors to conventional dryers (direct-heat type for sand and indirect-heat type for loess), one of which may be seen in the picture. The hot dry materials discharged from the dryers are raised by vertical bucket elevators (near the center of the barge) and discharged to insulated bins above the mixer. Semi-mechanical weighing devices under these bins feed the mixer. Hot asphalt is pumped from the asphalt barge through a circulating line that supplies a weighing hopper, also above the mixer. From the mixer the batch is fed across the barge in a horizontal screw conveyor at deck level to the inclined screw conveyor, shown against the side of the power house, from which it is discharged to hopper cars on the deck of the mattress barge. Also shown in the picture, above the dryers, are the dust collectors and washers through which pass exhaust gases from the dryers.

There are four hopper cars that operate on a track on the river edge of the upper deck of the mattress barge, as shown in Figs. 4 and 5. Fig. 5 shows the mixer barge in operating position behind the mattress barge, with one hopper car in loading position at the spout of the inclined delivery conveyor. From this spout the four cars travel (two upstream and two downstream) to supply the two finishing machines that distribute the asphalt mix over the deck to form the finished mattress. The finishing machines work from the ends of the mattress barge toward the center. One of the machines is shown at the far end of the deck in Fig. 5. The machines run on rails along the edges of the working area on the deck. The shoreward rail, together with its rack for the cog drive, is carried in a steel trough that is free of attachment to the deck over the full 217-ft. 6-in. width required for the mattress. This trough normally rests on the finished mattress and is held in alignment by detachable cables extending across the deck, as shown in Fig. 5.

Electric power for moving and operating both the finishing machines, the hopper cars and other mattress-barge machinery is taken from a feeder line from the power house on the mixer barge. A double "third rail" between the inner runway rails on the deck provides current to drive the hopper cars and the finishing machines, which are fitted with collector shoes to engage the conductors of the third rail.

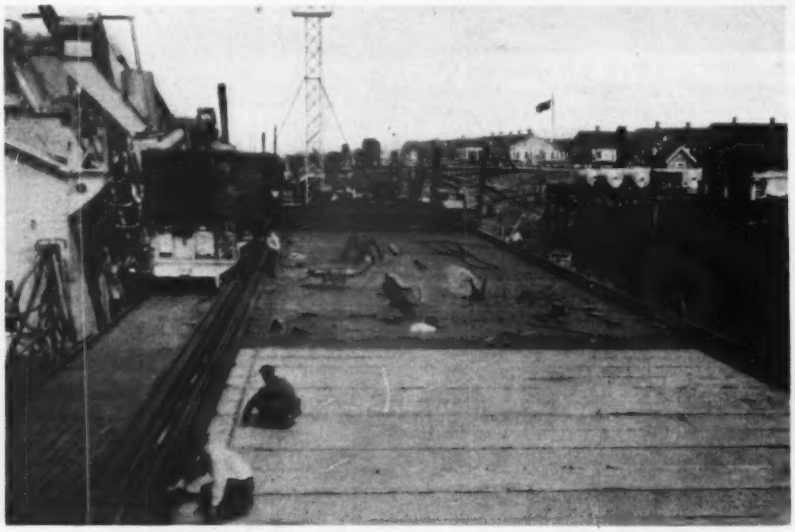


FIG. 5—ASPHALT REVETMENT MAT is formed on the barge deck here shown. Paper and reinforcing mesh feed to the deck through the slot shown between the rails at the left side of the deck; asphalt is distributed to two pavers spanning the deck by the hopper cars shown in the left center. One of the pavers is shown at the far end of the deck.

Mattress fabrication

The mattress is fabricated on the deck shown in Fig. 5, a section or "launch" 30 ft. wide and 217 ft. 6 in. long being formed in one operation and then launched off the deck over the curved apron when cooled sufficiently to handle. In the initial step of fabrication, sheets of kraft paper are drawn across the deck, as shown in the foreground in Fig. 5, and over this, at 3-ft. intervals, are drawn the launching cables and 6-ft.-wide strips of reinforcing mesh. The cables and mesh are attached to a steel header laid along the "shore" edge of the operating deck. The header is fastened to tackle, which is used to haul the mattress to and slightly beyond the water edge (Fig. 3). In this initial operation, before any mattress has been launched, the shoreward rail trough is supported on 2-in. wooden blocks.

The paper and wire mesh feed onto the deck through the slot, shown between the riverward rails (Fig. 5) and the launching cables feed up from below deck through small openings, all three being stored in rolls below the operating deck. The purpose of the paper is to keep the hot asphalt mix from sticking to the deck.

As laid on the deck, one line of launching cable lies between the parallel adjacent edges of the reinforcing mesh and one along the center of each 6-ft. strip. As soon as both are in place, the adjacent edges of the strips of mesh and the cable between them are stapled together at close intervals with a large hand-operated stapling device developed along the lines of a small stapler for fastening papers. The cable lying along the center of each strip of mesh is also

stapled to the mesh. In this manner the cables and mesh, when stapled together, form a continuous sheet of reinforcement for the mattress.

Wire chairs slipped under the mesh keep it about 1 in. above the deck so that it will be in the center of the 2-in. mattress.

As soon as the reinforcing sheet is completed, the asphalt placing is begun, one finishing machine working from each end of the deck. During preparation of the reinforcing-net, hot asphalt mix (20 tons to each of the four hopper cars, or enough for the entire launch) has been accumulated in the hopper cars. They are now moved to the ends of the working deck, and each in turn discharges in the finishing machine that it serves. The finishing machines are a development from the standard Barber-Greene pavers designed to meet the special requirements of the revetment work. Across the front of each is a horizontal steam-heated supply hopper containing a screw conveyor and an agitator which distribute and "fluff" the mix over the deck as the machine advances. Back of this hopper is a strike-off, and behind that are two steam-heated tamping bars with a variable stroke and speed. The tamping bars are actuated by cams on a drive shaft and tamp at an angle calculated to give a vertical resultant pressure with respect to the forward movement of the machine. Back of the tampers is an 18-in. steam-heated ironer which finishes the mattress.

As soon as the mattress is completed, the finishing machines are moved back clear of the mattress and cooling is completed by a sheet of water discharged across the upper surface of the sheet from a perforated pipe laid close to the riverward running rail for the finishing machines. The under surface of the sheet is cooled by jets of water directed against the underside of the deck plates from below. This under-deck cooling system also operates while the hot asphalt is being placed. When the mattress has acquired the strength (*i.e.*, cooled sufficiently) necessary to withstand the stresses incident to launching and laying, probably the greatest stresses it is ever called upon to withstand, the lowering mechanism is brought into play and the mattress is launched. During this launching operation the mattress plant is moved out into the river a distance to correspond with the length of the launch. Generally speaking, the first one or two launches must be hauled off the barge by a special arrangement of tackle blocks and cables, while, for succeeding launches, it is merely a matter of paying off the mattress under control, and the problem then becomes a rather difficult and unique braking problem. As it moves off, the mattress pulls up onto the deck the paper, mesh and cable for the succeeding launch. The shore end of the mattress is drawn up to its final position on shore in the manner indicated in the sketch of the plant.

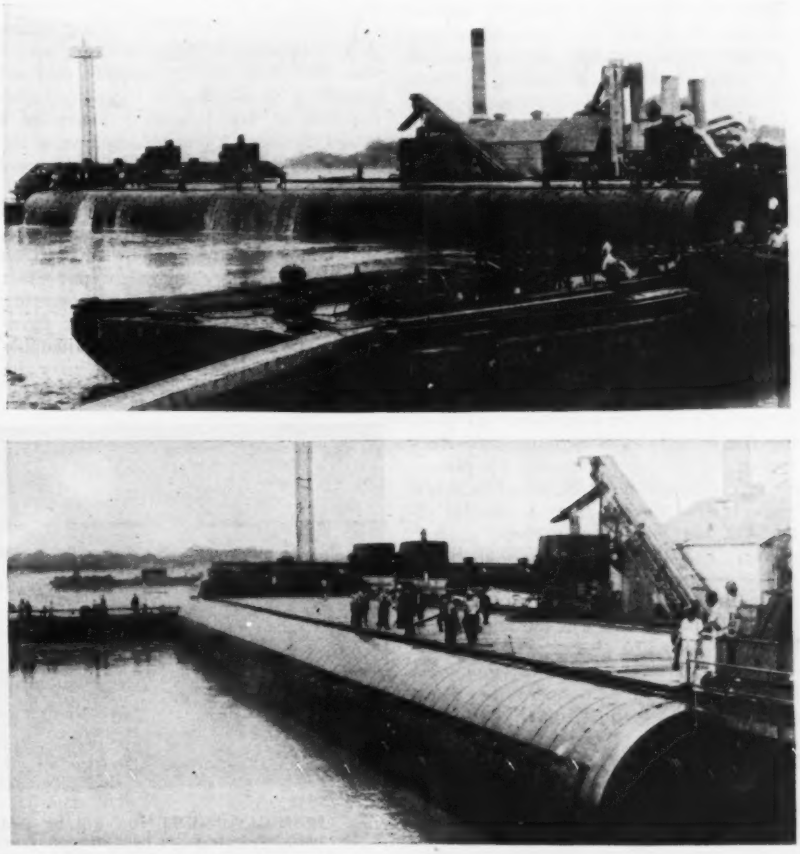
All operations of the mattress plant are directed from a control station on one of the shoreward corners of the mattress barge.

As previously stated, paper, reinforcing mesh and launching cable are fed onto the operating deck from rolls stored below the deck. Much ingenuity was displayed in the design of the operating deck and its supporting structure in order to permit the reinforcing mesh to flow from the rolls through the braking clamps and onto the deck at such close spacing as to permit of the mesh being stitched into a practically continuous sheet on the deck. To provide for this, the framework supporting the operating deck is carried on a pair of transverse channels set back to back with $\frac{3}{8}$-in. gusset plates riveted between them. It was not possible to use diagonal members, and these gusset plates were made correspondingly large and heavy. These supporting frames are spaced at intervals of 6 ft. $\frac{1}{2}$ in.; and as all the channel columns forming the support for the upper deck are riveted to the gusset plates an inch or so above the horizontal supporting channels, it is possible to feed the mesh through the framework just above the supporting channels with the only space between them being the $\frac{3}{8}$ in. required for the vertical plates. Reels of launching cables are hung above the sheet of mesh and feed up through control sheaves spaced at 3-ft. intervals to permit alternate lines to come up to the deck in the $\frac{3}{8}$-in. space between the strips of mesh. The paper rolls, approximately 3 ft. wide, are laid in troughs just below the slot through which the mesh feeds onto the deck. At the slot the continuity of the deck is carried past the line of openings by $\frac{3}{8}$-in. plates in the space between the sheets of mesh.

The brake clamps used to keep the reinforcing mesh taut on the deck are in the vertical plane as the mesh passes up to the deck. These clamps are hand-operated through a double-reduction worm drive. They serve only to stretch the reinforcing tight, which is the principal factor in properly supporting the reinforcing in the center of the mattress. The launching of the mattress is accomplished through the medium of, and controlled by, the launching cables. These cables are fed up to the deck through double-friction drums actuated by a motor-driven self-locking worm drive that gives the operator absolute control over the rate of launching and insures uniformity in the rate at which each cable is paid out.

On the deck the running rail and cog-

FIG. 6—TWO STAGES of asphalt-mat fabrication: above, cooling water being run over a freshly formed section of mat on the deck and cascading down over the previous section as it hangs on the launching apron; below, the outer end of a completed mat being lowered from the mattress barge. The initial step is shown in Fig. 1.



drive rail for the paver and the pipe for cooling water, both of which are in advance of the slot through which the mesh and paper feed to the deck, are supported on ⅜-in. plates extending up through the deck at 6 ft. ½-in. centers.

Heat control

Positive control of the heat of the asphalt mixture in order to deliver the mix on the operating deck at a temperature of 300 to 325 deg. F. was one of the important elements of the design and one that introduced new problems in the operation of some of the special equipment built for the job. Sand and loess are heated in passing through the dryers, and after they leave the dryers every precaution has been taken to retain this heat. Insulation is applied to the sides of the elevators, to the storage bins, screw conveyors and to the hopper cars on the deck and, in addition, steam heat is applied to the bottom of the hopper-car bins and steam jackets are used on the conveyor troughs and the hoppers of the pavers.

Asphalt is heated by steam in the hold of the asphalt and oil barge, and the hot asphalt is circulated by pumps through the line serving the mixer.

Electric pyrometers are located at the discharge ends of the three dryers, in the upper and lower parts of the sand and loess bins above the mixer, in the three weighing hoppers, on the asphalt supply line and in the mixer. All are connected to an indicator panel centrally located so that there may be observed at any instant the temperature at any one of the twelve points. Recording pyrometers in the inspector's house on the mixer barge are connected to the mixer to give a continuous record of temperatures and also, by recording the periodic rises due to the introduction of hot materials into the mixer, to give a permanent record of the time and length of each mix.

The mixing period is 2 min. Sand and loess are introduced into the mixer about 20 sec. ahead of the asphalt to mix them thoroughly before the asphalt is added. Discharge of the sand, loess and asphalt into the weighing hoppers is a manually controlled operation, but closing the feed gates is automatically controlled by switches actuated by photo-electric cells on the scale bars. In other respects the mixing plant is similar to that of an ordinary asphalt paving mixer. The batches weigh 6,000 lb.

The pyrometers at the discharge end of the dryers are connected to a recording instrument located in the inspector's house. Means are also provided to reduce automatically the fuel-oil supply to the burner if the temperature rises above a predetermined limit.

The power plant consists of an oil-burning water-tube boiler that supplies all steam required for heating purposes, as well as for a 500-kw. turbo-electric generator and certain other miscellaneous uses, such as pumping asphalt. Electric power is used to drive all machinery on the mixer barge and the mattress barge.

Operating schedule

The operating schedule calls for a sustained output of one "launch" (6,540 sq.ft.) of mattress per hour, but it is expected that this rate can ultimately be raised to one launch in 45 min. Actual distribution and tamping of the asphalt for a launch will take from 10 to 15 min. The remainder of the time cycle will be consumed in "sewing" the reinforcing together, setting the supporting chairs, cooling and launching. The mixer will run practically continuously, storing the mix in the four hopper cars.

Flood-lighting is provided for night operation. A crew of about 300 is required for operating two shifts.

Personnel

The design and construction of the asphalt-revetment plant were carried out under the immediate direction of Lieut.-Col. J. N. Hodges, district engineer, Second New Orleans Engineer District, and H. A. Thompson, chief of the operations division. Walter C. Carey was engineer in charge of the preliminary studies and design of the plant. The plant was constructed by government employees at the U. S. Engineer Depot, Second New Orleans Engineer District, under the late 1st Lieut. O. C. Torbett and H. D. Moore, superintendent of U. S. Engineer Depot. John W. Davitt, consulting engineer, and C. H. Giroux, R. Ticknor and C. M. Murray, of the marine design section of the office of the Chief of Engineers, rendered valuable service in connection with the detailed design of the plant. J. C. Field, chemist of the Asphalt Institute, co-operated in the laboratory and field studies concerning the use of cheap natural materials for aggregate and filler and has contributed greatly in the developments in these branches.

It will be interesting to note that 21 months was the total elapsed time from the initiation of the first studies and investigations of the possibilities of applying asphalt to subaqueous bank protection, as now contemplated, until the completion of the full-scale plant ready for field operation. The elapsed time between the decision to design and construct a full-scale plant and completion of the plant was one year.

Model for Testing Lights for Highways

A SEARCH for better seeing values (lighting conditions under which one sees most easily, quickly and accurately) in street and highway lighting will be undertaken by means of a model highway recently completed at the Nela Park laboratories of the General Electric Company, Cleveland, Ohio.

The highway represented by the model is 30 ft. wide. The roadway is crowned, has concrete curbs and 8-ft. green shoulders. Interchangeable pavement surfaces are provided, representing asphalt, concrete or a wet black pavement. The lighting units are adjustable for distance from curb and may be placed at any height up to 40-ft. full scale. Spacings of 125 to 500 ft. are available both for one-side mounting and a staggered arrangement.

The luminaire housings are so constructed that they may be shifted instantly from the gaseous-conductor source to the incandescent lamp or vice versa, and the amount of light from the sources can be varied and the distribution controlled by a simple change in the apertures. Built to a scale of one-eighth, the model is 240 ft. long, representing a 2,000-ft. stretch of highway. It is housed in a light-proof structure that permits of observation at all hours.

HIGHWAY MODEL that will be used to test the "seeing" values of tungsten and gaseous-conductor light sources. Provision has been made for raising and lowering various test obstacles and for moving them transversely to the street.

Effect on Slab Stresses of Area of Tire Contact

Area of contact of various tires under different loads determined by tests and slab stresses computed by Westergaard formulas

By M. C. Spangler
Associate Structural Engineer, Iowa State College, Ames, Iowa

THE PROBLEM of equitable distribution of taxes between highway vehicles of various weights, in order that one class may not enjoy a subsidy at the expense of other classes, depends to a very large extent upon the added increment of cost of construction and maintenance of a highway made necessary to provide adequate facilities for each weight class of vehicle. One phase of this problem is the matter of extra thickness of pavement slabs which is required to provide adequate structural strength for heavy truck and bus traffic as compared to the thickness required if the highway were limited to the lighter and more numerous vehicles. The solution of the problem was enhanced materially by the notable analysis of stresses in pavement slabs by H. M. Westergaard in 1925. ("Computation of Stresses in Concrete Roads." *Proc.*, 5th Annual Meeting of Highway Research Board, p. 90. Also, *Public Roads*, April, 1926.) In this analysis the traffic wheel loads on a pavement slab were assumed to be uniformly distributed over a circular or semi-circular area, and it was shown that the relationship betwen stress and load is dependent to an important degree upon the radius of this area. It is necessary, therefore, to know the relationship that exists between the area of contact between tire and pavement and the wheel load before the stresses in a pavement slab due to any particular vehicle may be determined.

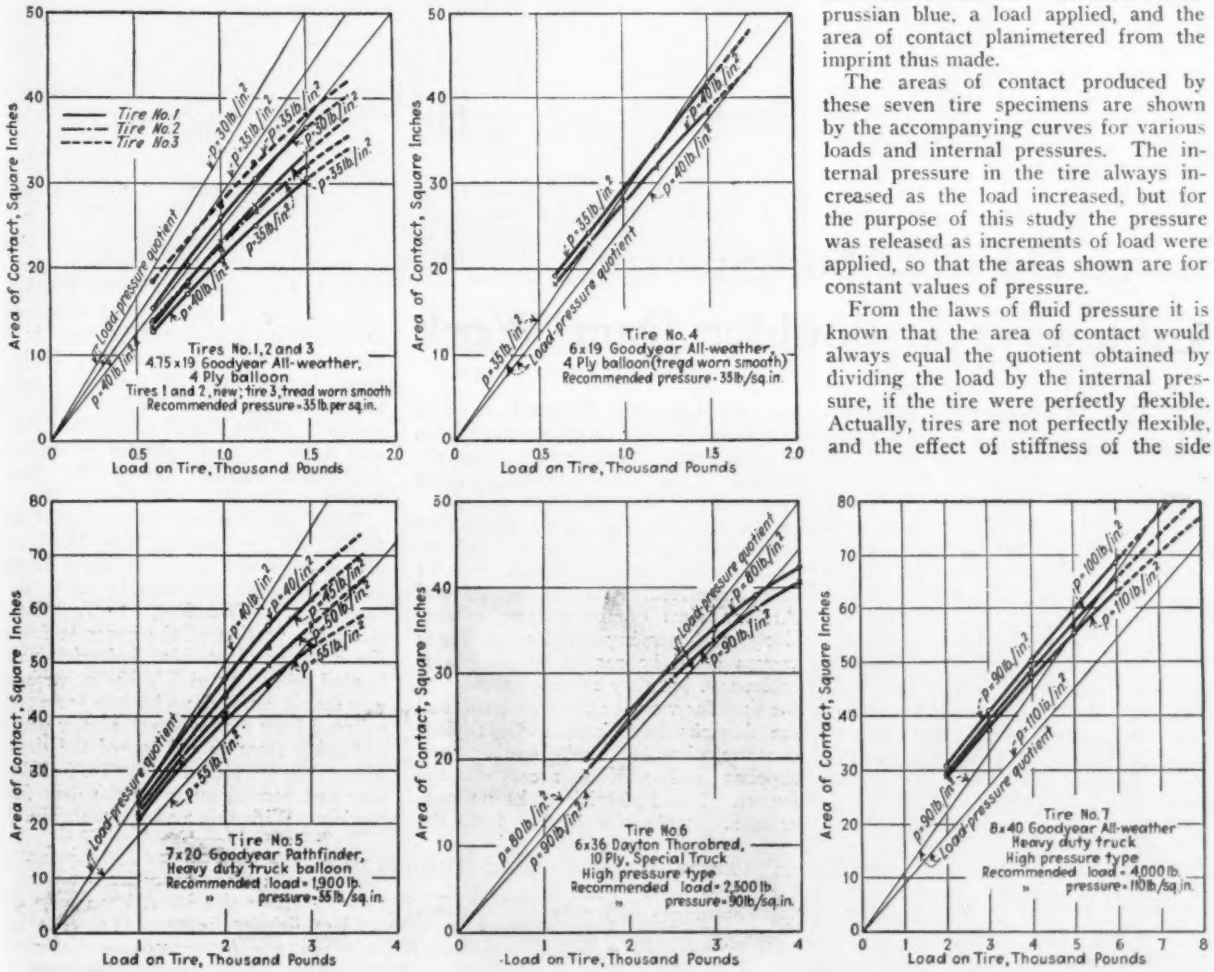
Pressure area tests

The author has conducted a limited study of this subject at the suggestion of Thomas R. Agg, director, Iowa Engineering Experiment Station. In this study the area of contact between a smooth surface, analogous to a pavement slab, and seven different tires under various loads and internal pressures have been measured. A description of the various tires and the manufacturer's recommendation as to maximum operating load and internal pressure are given in Table I.

The tires were mounted on a wheel and axle and placed in a testing machine. A piece of 3x10 plank was fastened to the upper head of the machine, with a sheet of paper attached. Then the tread of the tire was coated with prussian blue, a load applied, and the area of contact planimetered from the imprint thus made.

The areas of contact produced by these seven tire specimens are shown by the accompanying curves for various loads and internal pressures. The internal pressure in the tire always increased as the load increased, but for the purpose of this study the pressure was released as increments of load were applied, so that the areas shown are for constant values of pressure.

From the laws of fluid pressure it is known that the area of contact would always equal the quotient obtained by dividing the load by the internal pressure, if the tire were perfectly flexible. Actually, tires are not perfectly flexible, and the effect of stiffness of the side


Area of Contact, Square Inches
Load on Tire, Thousand Pounds
Tire No. 1
Tire No. 2
Tire No. 3
Load-pressure quotient
Tires No. 1, 2 and 3
4.75 x 19 Goodyear All-weather, 4 Ply balloon
Tires 1 and 2, new; tire 3, tread worn smooth
Recommended pressure - 35 lb. per sq. in.
Tire No. 4
6 x 19 Goodyear All-weather, 4 Ply balloon (tread worn smooth)
Recommended pressure - 35 lb./sq. in.
Tire No. 5
7 x 20 Goodyear Pathfinder, Heavy duty truck balloon
Recommended load - 1,900 lb.
" pressure - 55 lb./sq. in.
Tire No. 6
6 x 36 Dayton Thorobred, 10 Ply, Special Truck
High pressure type
Recommended load - 2,500 lb.
" pressure - 90 lb./sq. in.
Tire No. 7
8 x 40 Goodyear All-weather
Heavy duty truck
High pressure type
Recommended load - 4,000 lb.
" pressure - 110 lb./sq. in.

RELATION between load on tire and area of contact between tire and pavement for seven different tires designed for pressures varying from 35 to 110 lb. per sq.in.

TABLE I—TYPES AND SIZES OF TIRES TESTED TO DETERMINE PRESSURE AREAS

Specimen No.	Size of Tire, In.	Description	Type	New or Used	Manufacturer's Recommendation Load, Lb.	Manufacturer's Recommendation Pressure, Lb./Sq. In.
1	4.75x19	Goodyear all-weather 4-ply	B	New	....	35
2	4.75x19	Goodyear all-weather 4-ply	B	New	....	35
3	4.75x19	Goodyear all-weather 4-ply	B	Used	....	35
4	6.00x19	Goodyear all-weather 4-ply	B	Used	....	35
5	7.00x20	Goodyear Pathfinder Heavy-duty truck	B	Nearly New	1,900	55
6	6.00x36	Dayton Thorobred 10-ply Heavy-duty truck	HP	New	2,500	90
7	8.00x40	Goodyear all-weather Heavy-duty truck	HP	New	4,000	110

B indicates balloon type; HP indicates high-pressure type.

TABLE II—STRESSES IN PAVEMENT SLAB AS CALCULATED FROM TEST DATA BY WESTERGAARD FORMULAS

Wheel Load (2 Tires)	Area of Contact, Sq. In.	Radius of Equivalent Area-In.		Critical Tension in 8-in. pavement slab, Lb. Per. Sq. In.		
		Circle	Semi-Circle	Case I	Case II	Case III
4,000	57.2	4.27	6.03	128	99	135
6,000	74.6	4.87	6.89	184	142	190
8,000	94.4	5.48	7.76	235	183	238
10,000	111.2	5.96	8.41	286	222	285
12,000	125.8	6.33	8.95	334	261	329
14,000	140.8*	6.70	9.47	380	298	370
16,000	155.4*	7.03	9.94	432	334	410

*Areas extrapolated.

walls and tread is clearly shown for these seven tires.

With these data it is of value to calculate the stresses in an 8-in. pavement slab by means of the Westergaard formulas, due to an imaginary truck equipped with one of the truck tires used in this experiment, to ascertain the effect on stresses of the enlarging area of contact as the load produced by the truck increases, due to impact or other causes. For this calculation a truck wheel has been assumed to be equipped with dual tires, and the load has been assumed to be applied to the slab over a circular or semi-circular area (as the case may be) equal to the total area of contact of the two tires.

Westergaard has analyzed three cases of loading. In case I the load is applied over a circular area at the corner of a slab. In case II the load is applied over a circular area at a considerable distance from the edge of a slab. In case III the load is applied over a semi-circular area at the edge of a slab, but a considerable distance from any corner. The formulas for the critical tension stresses for these loadings are:

Case I

$$S_c = \frac{3P}{h^2}\left[1-\left(\frac{12\,(1-\mu^2)k}{Eh^3}\right)^{0.15}\right]^{0.6}\left[\frac{(a\sqrt{2})}{}\right]$$

Case II

$$S_i = 0.3162\,\frac{P}{h^2}\left[\log_{10}(h^3) - 4\log_{10}\left(\sqrt{1.6a^2+h^2} - 0.675h\right) - \log_{10}k + 6.478\right]$$

Case III

$$S_e = 0.572\,\frac{P}{h^2}\left[\log_{10}(h^3) - 4\log_{10}\left(\sqrt{1.6a^2+h^2} - 0.675h\right) - \log_{10}k + 5.767\right]$$

The following notation applies:

S_c, S_i, S_e = critical tension stresses at a corner, at the interior, and at an edge, respectively.

P = total load.

h = depth of slab (in this study, 8 in.)

a = radius of the circular or semi-circular area over which the load is applied.

k = modulus of subgrade reaction (in this study, 50 lb./in.^{3}).

E = modulus of elasticity of concrete (3,000,000).

μ = Poisson's ratio (in this study, 0.15).

The results are shown in Table II. These calculations show that the load-stress relationship is not a straight line, the stress increasing less rapidly than the load, although the deviation from a straight line is not very marked.

Large Derricks Supplement Cableways on Boulder Dam Work

EARLY in the progress of construction on Boulder Dam it was found desirable to make some changes in the assignment of work to the several cableways, and additional equipment was provided in the form of three steel stiff-leg derricks. A derrick was put in to handle material for the intake towers on each side of the river, and a third and still larger one on the Nevada side was provided to aid in delivering concrete from the low-mix plant to the Nevada end of the dam, from El. 720 (railroad grade from low-mix plant) to El. 950. All three of these derricks, which are perched on the sheer canyon walls, have performed their functions effectively and satisfactorily. Their notable features are the very large sizes, the details of which are listed in the accompanying table. The cableway arrangement was described in an article in *Engineering News-Record*, Dec. 21, 1933, p. 743.

The derricks that serve the intake towers are in large measure duplicate installations. Derricks Nos. 1 (Fig. 1) and 2 are located on the Nevada and Arizona rims of the canyon, respectively, each serving two towers. These towers could be served by the major cableways, but they are needed most of the time for work on the dam itself, and the derricks have been used to place concrete, handle steel, lumber and supplies and provide access to the towers. No. 1 derrick picks up concrete and materials directly from the railroad at El. 1,230 on the Nevada rim of the canyon. No. 2 derrick picks up its loads from a platform on the Arizona side, to which concrete and materials are delivered across the canyon by a 12-ton fixed cableway (No. 10). Major items in the material for the intake towers include about 100,000 cu.yd. of concrete, 10,000 tons of reinforcing steel and 5,000 tons of cylinder gates, all distributed equally among the four towers.

When the dam had been brought up to El. 720, the railroad from the low-mix plant on that grade no longer could extend through the dam to serve the cableways. Therefore, to continue placing a portion of the concrete from the low-mix plant, No. 3 derrick was located with base at El. 930 in such a way that it can pick up buckets from the railroad from the low-level mixing plant and relay them to the top of the dam, where they are picked up by No. 6 cableway and carried out over the dam for placing. With this arrangement, No. 5

THREE LARGE STIFF-LEG DERRICKS AT BOULDER DAM

No.	Boom Length, Ft.	Bull Ring Dia., Ft.	Mast Height, Ft.	Capacity (Boom Flat), Tons	Motor Rating: Hoist and Boom, Hp.	Motor Rating: Swing, Hp.	Motor Rating: Volts	Tackle: Boom: Parts in Tackle	Tackle: Boom: Cable Size, In.	Tackle: Hoisting: Parts in Tackle	Tackle: Hoisting: Cable Size, In.	Line Speed, Ft. Min.	Swinging Speed, R.P.M.	Function
1	180	30	75	12	300	40	440	10	1	3	1	800	1	Two Nev. intake towers
2	180	30	75	12	250	40	2,300	10	1	3	1	650	1	Two Ariz. intake towers
3	140	20	65	20	500	50	2,300	10	1	3	1	1,200	1	Conc. in Nev. end of dam between El 720 and 930

FIG. 1—TWELVE-TON DERRICK (No. 1) above the two intake towers on the Nevada side.

cableway picks buckets directly from the railroad and places them in the upstream quarter of the dam. Up and downstream movement is obtained by traveling towers. The No. 6 cableway receives its concrete by means of the derrick, reducing the tower travel of this cableway. Cableways 7 and 8 serve the lower half of the dam and pick up buckets coming from the high-mix plant on the El. 1,230 railroad on top. The No. 3 derrick also places concrete directly in a number of blocks that are within its reach and was expected to be kept in operation until the dam reached El. 950. To this derrick was assigned the handling of about 250,000 cu.yd. of concrete (roughly 500,000 tons).

Derrick No. 3 is of the self-slewing type with swinging engine and main hoist mounted directly on a cantilever platform that revolves with the derrick. A 20-ft. bull gear is fixed to the concrete base, and the swinger pinion rotates around the outside of this gear. The top of the mast is fitted with a 9-in. pin, which rotates on roller bearings in a steel head casting, to which the stiff-legs are fastened. Steel and bronze laminated thrust bearings are provided for the vertical reaction that occurs at this point.

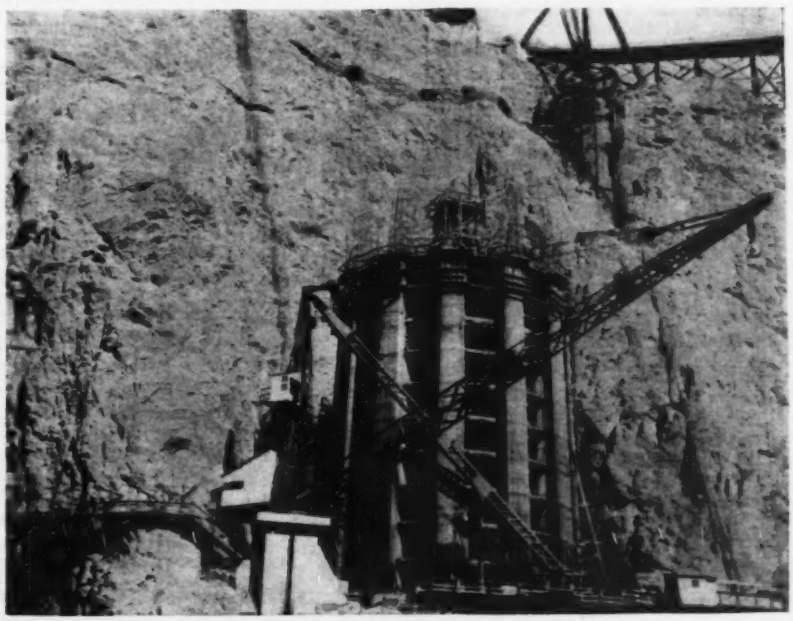
At the base of the derrick the mast and operating platform rest on a steel casting. The rotating pin in this base is 13 in. in diameter and revolves in a bronze bushing 18 in. long. Vertical thrust is carried on laminated steel and bronze washers. Rotating parts of the base are run continually in a bath of oil. In order to eliminate eccentricity and provide for tilting at the base, a spherical seat is provided below the rotating parts and incorporated in the cast-steel base.

The three-drum hoist on derrick No. 3 is provided with air brakes and frictions. The electrical apparatus provides for full regenerative counter-torque control, and a compressed-air supply is provided by a 50-cu.ft. compressor mounted on the derrick platform. The operator's cab is mounted on the side of the mast about half way up so as to be in a position giving a full view of the field of operation. Air brakes and all electrical controls are located in this cab.

For the most part all the derrick hoists are located so that the operator can see the loading and delivery points and thus can get his signals directly from the workmen who load and unload his hook. Operators on none of these derricks have helpers. Greasing, oiling and other maintenance jobs are done by the crew of mechanics who attend systematically to cableways, derricks and other "plant" located along the canyon walls.

All three derricks were designed by the engineering staff of Six Companies, Inc.

FIG. 2—TWENTY-TON DERRICK (No. 3) taking load from concrete train, showing one of the Nevada intake towers in background and, far above, the "overhanging" perch for derrick No. 1.



Engineering Aspects of the Present Midwest Drought

Precipitation of 50 per cent normal from January to May over twelve states sets new low-flow record for rivers, depletes groundwater supplies and threatens public water supplies for late summer—Drifting sand causes highway problems

PRECIPITATION of less than half of normal during the first five months of the year over twelve states in the Middle West has produced the "most extensive drought in the climatological history of the United States." The unprecedented dust storms of May and the subsequent reports of serious damage to agriculture, have forecast serious engineering consequences of the drought which are now just being appraised. Although the full effect has not been determined, the preliminary reports from national agencies and local observers indicate: (1) record low flows in rivers, (2) rapidly falling levels of groundwater supplies, (3) possibilities of serious deficiency in certain municipal water supplies, (4) aggravation of sewage-disposal problems and (5) highway maintenance affected by drifting sands. Some of these engineering aspects and the results of observations in the affected area are outlined.

A general statement reviewing the precipitation record at the end of May was presented by J. B. Kincer, U. S. Weather Bureau, in a release of that organization, and is summarized below:

"At the end of May the most extensive drought in the climatological history of the United States had developed in the interior, and in the northwestern and western states. In the Northwest, precipitation prior to 1934 had been below normal for several years. For example, in Minnesota every one of the last five years up to and including 1933 had below-normal rainfall, with an accumulated deficiency of 18.62 in., and since the beginning of 1934 the shortage has become greater at a more rapid rate than heretofore. The accumulated deficiency for North Dakota during the past five years is 12.54 in., while for the three spring months (March to May, 1934) there was an average for the state of only 1.27 in., which was by far the lowest ever recorded for these months. In the Ohio Valley the drought is of more recent inception. In this area the deficiencies in rainfall began generally just about a year ago, but nearly every month since then has had less than normal.

"The present drought differs in several respects from that of 1930, and in some ways is very unusual. Seldom does a severe drought begin so early in the year, and in no other case of record has one at any time covered such extensive areas as at present. In general, it is severe throughout the Ohio and central and upper Mississippi Valleys, the central and northern Plains, most of the Rocky Mountain sections, and in the Great Basin of the West, covering approximately three-fourths of the country. The 1930 drought spread from the East-Central States westward over the central valleys, while the present one has spread from the Northwest westward, southward and eastward.

"The accompanying chart shows the percentage of normal for the three spring months, March, April and May. It was the driest spring of record in both the Dakotas, Minnesota, Nebraska, Iowa and Illinois, and the second driest of record in Ohio, Indiana, Wisconsin, Missouri and Kansas. In Illinois, for example, the total rainfall for the three months was only 5.21 in., the previous low record was 6.06 in. In Minnesota the previous low spring record of 3.39 in. was more than 20 per cent greater than the 2.79 in. received this spring. North Dakota had only 1.27 in. of rain during the three months, and the previous low record of 2.15 in. in 1901 was nearly 70 per cent greater than this."

Record by states

The records of the U. S. Weather Bureau show that for each week from Jan. 1 to May 31 precipitation was below normal and the temperature above normal over extensive areas in the upper Missouri and upper Mississippi River basins, with a maximum deficiency centering over the two Dakotas. Abnormally high wind movements during this period, combined with the deficiency in precipitation, resulted in extensive dust storms which continued practically the entire month of May.

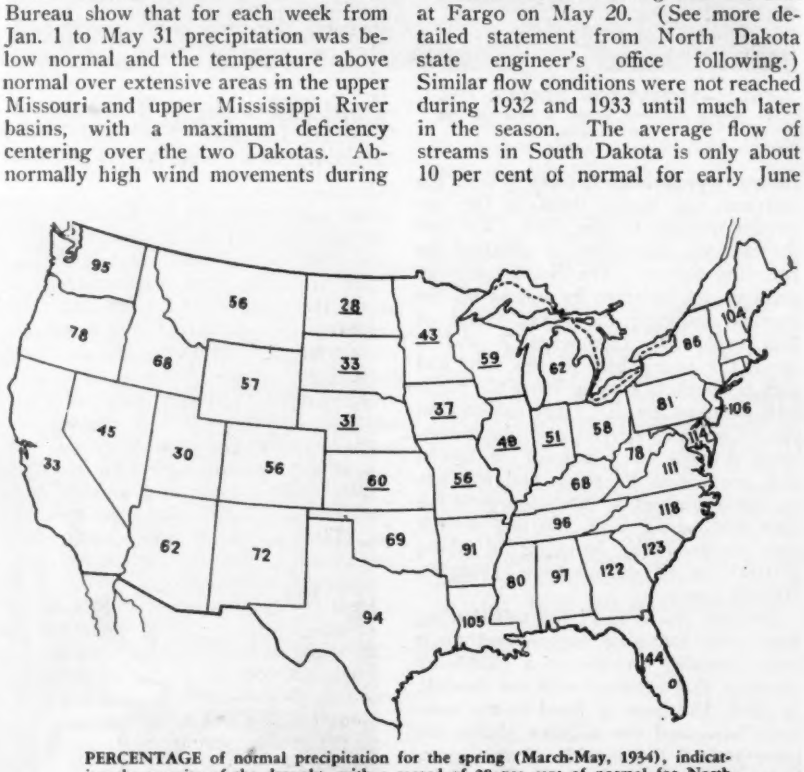
The severity of the drought is indicated by the precipitation records for the period from January to May:

	Jan. to May, 1934 (In.)	Normal (In.)	Per Cent of Normal
Montana	3.46	5.93	58
North Dakota	1.53	5.45	28
South Dakota	2.48	7.40	33
Nebraska	3.36	8.35	40
Kansas	6.27	9.47	66
Minnesota	3.58	7.94	45
Iowa	4.52	10.76	42
Missouri	9.15	16.06	57
Wisconsin	5.91	10.34	58
Illinois	7.28	15.04	49
Indiana	7.98	16.83	48
Ohio	8.47	15.85	53
Aver.	5.3	10.8	48

Effect on water resources

Reports show that the deficiency in precipitation has resulted in extensive depletion of streamflow over the entire Midwest section. Streams draining the high mountain areas of Wyoming for the period from October, 1933, to April, 1934, averaged only about 50 per cent of normal, and the flow of streams on the Wyoming plains has been only slightly above one-third of normal.

The North Dakota tributaries of the Missouri River reached "pool" stage during the month of May, which is the lowest flow on record for this time of the year. The normal flow of the Red River of the North at Fargo, N. D., for May is about 744 sec.-ft., but this year the stream ceased flowing over the dam at Fargo on May 20. (See more detailed statement from North Dakota state engineer's office following.) Similar flow conditions were not reached during 1932 and 1933 until much later in the season. The average flow of streams in South Dakota is only about 10 per cent of normal for early June



PERCENTAGE of normal precipitation for the spring (March-May, 1934), indicating the severity of the drought, with a record of 28 per cent of normal for North Dakota. Underlined figures indicate the lowest spring rainfall of record.

and is less than one-half the flow of any June for the last six years.

The present severe drought, following a prolonged series of years with subnormal precipitation, has resulted in a continued and accelerating lowering of groundwater levels. Abnormally high temperatures during the past spring have aggravated this decline. Pumping depths are greatly increased, and many of the shallower wells do not now reach to the present groundwater table. Reduction in groundwater supply has resulted in decreasing or completely drying up springs and many surface sources of supply. With subsurface moisture so seriously depleted, there is slight prospect for substantial recharge of this supply before next spring, and only a rainfall above normal will be of any material assistance.

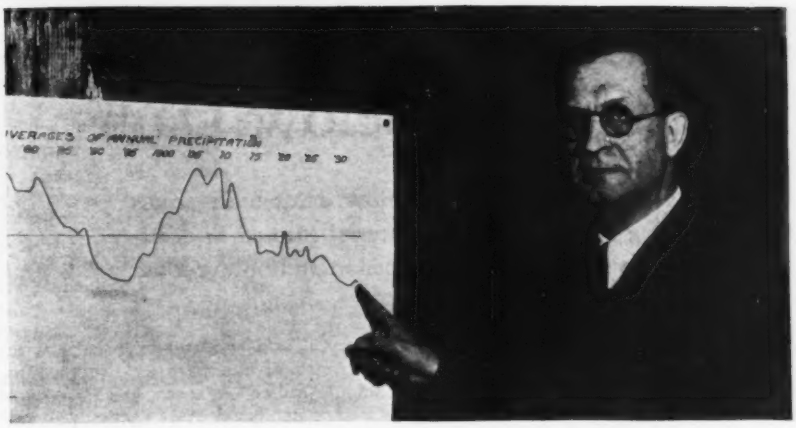
Geologically, almost the entire area of the Dakotas is underlain by water-bearing formations of sandstone, which constitute large underground reservoirs that can be reached for municipal, domestic and livestock use to meet the emergency. The problem, however, involves the time and the cost required to drill the necessary wells.

Deposits of glacial drift occur over extensive sections of eastern South Dakota and all but a small section of North Dakota. The water-bearing sands and gravels of this drift have probably been considerably depleted in water content, but the deeper beds where the drift has a greater thickness probably are not seriously affected and can be expected to yield supplies for emergency wells. One of the most serious situations is in the area of South Dakota lying west of the Missouri River, where both the underlying sandstone and the glacial drift are absent and where water supplies in the past have been developed from shallow wells.

Federal relief

To provide relief for families in the drought-stricken area, and at the same time to develop the necessary emergency facilities, 150,000 farmers in this region (75,000 in the two Dakotas) have been employed in building roads, drilling wells, pumping and hauling water under emergency relief-work agencies. The FERA is now making a careful survey in each state to determine the number of families that are in serious need and is outlining a definite program for relief for several months ahead. In some areas this program of relief will tie in with the rural rehabilitation program of the FERA in which housing will be one of the major elements.

"Take, for example, a family in South Dakota," said Administrator Hopkins, "on submarginal land where they have never made a proper living. The present drought came along, and the farmer is now completely licked and goes on the relief roll 100 per cent. We propose to move that family on to a farm where they can be assured of a living. In that case we would help him build a home. In South Dakota the state owns a good deal of land which can be used for such a purpose."



PRECIPITATION RECORD for St. Paul, Minn. (ten-year moving average), showing the trough of an apparent rainfall cycle, indicated by J. C. Kincer, U. S. Weather Bureau.

North Dakota conditions

At the request of this journal a brief review of the outstanding engineering phases of the drought in North Dakota has been prepared by Waldo E. Smith, deputy state engineer, and is presented in the following statement.

During the first week in June, reports Mr. Smith, the extreme situation was partly relieved in North Dakota by rainfall varying from 1 to 3 in. However, without continuing rains the drought conditions will re-occur in greater severity. The deficiency in water supply has affected many towns and smaller communities, with use curtailed, and in some instances hauling of water has been resorted to for domestic use.

Jamestown (8,000 population) on the James River about 100 miles west of the Minnesota boundary, obtains its supply from wells about 80 ft. deep. Within the last few months groundwater level has lowered so much that additional wells are being sunk. Throughout the state the groundwater level had been receding for many years even before the subnormal precipitation of the last four or five years.

Devils Lake, formerly a body of water with an area of about 125 square miles, is now only a chain of alkali ponds, having an aggregate area of about 30 square miles. The vertical drop in the water surface of this lake has been about 30 ft. This decline in water surface has been going on almost continuously since the area was first settled in 1860, but the recent conditions have accelerated the decline. Many small lakes throughout the state have completely disappeared. Skunk Lake in the southeast corner of the state, which formerly occupied about 3 square miles, was completely dry during the present spring and the lake bed was placed under cultivation. The recent rains have flooded these crops in the lake bottom to a depth of about 2½ ft. In many cases the old lake beds are now alkali flats that are entirely unfit for cultivation.

Fargo (30,000 population), which obtains its water supply from the Red River of the North, found it necessary to increase the height of its dam in 1931. During the summer of 1932 and the winter of 1932-33, shortage of streamflow resulted in the construction of a second dam that more than doubled the storage capacity. There has been no actual shortage of supply, but the low flow and the double storage of the water have added to the purification difficulties.

Sand on highways

The dust blown by the high winds of the spring has filled many drainage ditches along highways and county roads and, should a period of wet weather be experienced before these ditches are opened, the resulting floods might do considerable damage. According to J. N. Roherty of the state highway department, it has been estimated that between 5 and 10 per cent of the ditches along the state highway system are filled with wind-borne dust and sand to such an extent that their drainage value has been destroyed. It is the plan of the department to wait until harvesting has been finished and then remove this rich soil by scrapers and deposit it on the adjacent land.

On a small part of the highway system mileage (estimated at 100 miles) the dust drifted on to the road surface to such an extent that it will have to be removed by scrapers. On a considerable mileage in the northwestern section of the state the binder in the sand clay and graveled roads, which was thoroughly dried out, was blown out by the wind. On this mileage the binder material will have to be replaced either by material from the shoulders or by material hauled in for that purpose. The former operation can be done in connection with ordinary maintenance work, but the latter would involve considerable expense.

Retrogression of Levels in Riverbeds Below Dams

Data on retrogression of levels below dams built across streams having beds of movable material studied to determine possible effect of this phenomenon at Boulder Dam

By E. W. Lane

Research Engineer, U. S. Bureau of Reclamation, Denver, Colo.

STUDIES UNDERTAKEN by the U. S. Bureau of Reclamation to determine the possible effect of the phenomena of retrogression of bed levels below dams upon the design of the power plant at Boulder Dam are outlined in the accompanying article by E. W. Lane. Following it are three supplementary statements giving further details of some of the instances of degradation cited by him. These four statements emphasize the need for fuller engineering study of these interesting phenomena.—EDITOR.

WHEN A DAM is constructed in a stream with a bed of movable material, part of the material which the stream transports will be deposited in the backwater area of the reservoir. The flow passing the dam, having been partly relieved of its load, will pick up material from the riverbed below the dam and thus cause a retrogression of the bed level there.

This phenomenon is important in connection with the Boulder Dam project, as it is expected that the reservoir upstream from the dam will settle out practically all the heavy load of silt normally carried by the Colorado River water, and the clear water discharged will pick up the bed material downstream and cause a lowering of the water level. The reader should understand that the bedrock on this stretch of the Colorado is overlaid by a deep layer of sediment. The erosion of this bed will increase the head at the power house and add considerably to the available power. If provision had not been made in the power-house design for this lowering of water level by lengthening the turbine draft tubes, the river surface might fall below the bottom of these tubes and permit air to enter them, which would destroy their effect and cause a reduction of power output rather than an increase.

In order to enable more accurate estimates of these effects to be made, all the available information was collected. It was found that degradation of the riverbed had become evident at a number of dams, in one case being sufficient to cause the failure of an important structure. As this phenomenon is likely to become even more important in the future, this article is written to call it to the attention of engineers and to summarize the data regarding its action.

The existence of retrogression of the riverbed below dams is no recent discovery. As a result of experience with the weirs of the Madras Province in India, Mullins states in his *Irrigation Manual*, published in 1890, that "A retrogression of the level in the riverbed is a nearly inevitable result of building a weir." In 1917, G. K. Gilbert wrote, "It is abundantly evident that a dam founded on a riverbed of movable material will promote erosion on the downstream side in the same manner that it promotes deposition on the upstream side, and that such erosion is a factor to be reckoned with by the engineer."

Weirs of the Sutlej River

The most costly failure due to retrogression seems to be that of the Islam weir of the Sutlej Valley project in India. (Report by Islam inquiry committee into failure of the Islam weir—Public Works Department, Punjab.) This weir is one of four somewhat similar large structures built on the Sutlej River in the Punjab, India, as diversion dams for the canals of that immense irrigation project. It is of the barrage type, 1,621 ft. long with 24 openings of 60-ft. span each. It has broad upstream and downstream concrete aprons, the latter sloping down for some distance and then extending horizontally, ending without an appreciable cutoff wall. Downstream from the concrete apron were concrete blocks and heavy riprap. The dam sustained a maximum head of 18 ft. and was put in service in the spring of 1927. By November of that year the bed downstream had dropped 2.3 ft. The lowering to December, 1928, was 5.5 ft., and by May, 1929, it had reached 6.5 ft., the water level in the river being 4 ft. below the floor of the weir. The scour resulting from this drop was so severe that a large portion of the downstream apron was destroyed, and finally six bays of the structure collapsed.

Serious retrogression has also taken place at the Ferozepore and Suleimanke weirs of this system. At the former the retrogression reached a maximum of 5 ft. the same year that it was put into service, but the bottom has since tended to rise, no doubt due to the filling of the pond upstream and the tendency toward the restoration of the normal supply of material from upstream. At the Suleimanke weir, retrogression was noticed the first year of its service. It reached a maximum of 6.2 ft. in the second year but recovered to 4.0 ft. in the third year. The riverbed at all of these structures is composed of sand, and the river has a slope of about 1.1 ft. per mile.

Yuba River débris barrier

One of the most striking examples of retrogression below a dam is that which occurred at the barrier erected on the Yuba River about 14 miles above Marysville, Calif., to restrain the débris that was then coming down the river as a result of hydraulic mining operations. Fortunately, the account of the case is very complete, due largely to the efforts of S. K. Gilbert, who was intensely interested in river dynamics. (See U. S. Geological Survey Professional Paper 105, 1917, p. 52—*Transactions*, Am. Soc. C. E., Vol. LVII, 1906, p. 1, and Vol. LXXI, 1911, p. 217.)

This barrier was constructed in two stages or lifts. The first lift of the barrier was constructed in 1904 with a height of 6 ft. and a length of 1,250 ft. It consisted of rows of piles tied together by cables, filled between with rock and covered with a layer of concrete, forming an ogee-shaped crest and a short horizontal apron. The basin above this barrier was filled during the first winter, and in 1905 a second lift of similar construction was built on this fill to a total height of 14 ft. Before the construction of this lift a contour map with 2-ft. contour intervals was made of the region above and below the dam, and a year later a similar map was made to show the deposition and retrogression. The basin above the second lift was nearly filled by the first flood, other floods followed, and the barrier was finally breached by the flood of March, 1907, which released nearly all the stored material and restored the river to the conditions existing before the barrier was constructed. The cause of the failure is not clear. It may have been due to retrogression of the downstream level or to destruction of the concrete topping of the dam by abrasion of the material carried over it, or to a combination of these causes.

Before the barrier was built, the slope of the riverbed at the site was 16 ft. per mile, increasing rapidly upstream to 22 ft. per mile.

After the first lift was built, the deposits extended somewhat more than 1½ miles upstream and, at the time the first contour map was made, had reduced the slope to 12 ft. per mile. After the first flood following the completion of the second lift of the barrier, the deposits extended 1¾ miles upstream, and the slope was reduced to 9 ft. per mile. Subsequent floods filled farther upstream and had restored the gradient to nearly 12 ft. per mile, when the second map was made. The flood of 1907 probably restored the bed nearly to the original 16 ft. per mile before the dam was breached.

The records of streamflow during this period are available in detail at a measuring station 5 miles above the barrier. (Water Supply Paper No. 213, 1907, pp. 142 and 143.) The first flood after the completion of the second step reached a peak of 48,000 sec.-ft., and the volume of water passing during the flood totaled about 17.1 billion cu.ft., or 633 million cu.yd. The total deposit above the dam was 920,000 cu.yd., or 0.14 per cent by volume of the river flow. Later floods brought the deposit up to 1,690,000 cu.yd. Samples showed this to be composed of 0.6 per cent less than 80-mesh-per-inch size, 1.8 per cent less than 8-mesh-per-inch, and the remainder ranging up to boulders 1 ft. in diameter, the greater part being relatively fine material.

The retrogression after the first lift of the barrier was built averaged probably 2 to 3 ft. The floods of 1906 after the construction of the second lift reduced the levels over a large flat area by 2 to 3 ft. but concentrated the recession in a deeper channel which was lowered an average of 9 ft., while the line of greatest depth of channel averaged 19 ft. lower than the deepest channel after the first lift was completed. From the area covered by the survey, which extended one-half mile downstream, 532,000 cu.yd. of bed material was removed, but the total may have been two or more times this much. It is probable that the material removed was somewhat coarser than that deposited in the pool, as previously described.

Retrogression at other dams

At the Junction plant on the Manistee River the retrogression has been going on at the rate of 1 ft. a year for the last twelve years, and consequently it has been necessary to extend the draft tubes and build a sheetpile weir below the dam to maintain the tailwater level. The height of the dam is 50 ft., which probably causes a sufficiently low velocity in the pool to remove most of the transported load. The river at this point has a slope of about 3 ft. per mile, and the bottom for many miles downstream is composed of mud and sand. The Manistee River has a very uniform flow, the maximum daily mean flow being only 6.75 times the minimum. The discharge at this plant for approximately 50 per cent of the time is less than 1,900 sec.-ft.

At the Foote Dam on the Au Sable River a rapid lowering was at first observed, but a bed of clay was soon uncovered and further degradation practically ceased. The total drop has been 5 ft. in fifteen years. At one dam on the Wisconsin River a lowering of 7.5 ft. is said to have occurred in eighteen years. This river has an average slope of 1.45 ft. per mile and a mean discharge of about 8,500 sec.-ft. The bed is about 1,000 ft. wide and is composed to a great depth of a sand with nearly uniform grain size of 0.03 in. Experience on other rivers indicates that retrogression has in some cases been stopped when gravel bars were uncovered, or when all the fine material was removed, leaving only the coarser particles.

It is stated that in Michigan, where the deep glacial drift is predisposed to the cutting action, it is generally noticeable that almost every old mill dam has a spillway apron several feet above normal downstream level, although the typical design and construction of such structures have always been to build the apron below water level. The undermining and resulting troubles have probably been the chief source of failure of these old dams.

Observations on western rivers

A recession of river levels on the Rio Grande was observed below the Elephant Butte Dam. This stream has a slope of about 3.8 ft. per mile in the vicinity of the dam and sometimes carries as high as 10 per cent by weight of silt. The average silt content is 1.65 per cent. Practically all of the silt is settled out in the reservoir, and soon after the dam was completed a retrogression of 7 to 10 ft. resulted a short distance below the dam and changes of 1 to 2 ft. occurred in places for 50 to 100 miles below. This change might have been greater were it not for the effect of several intake dams which fixed the river grades at their crests. The floods from the tributaries, however, continued to bring in material, much of which was coarse. This action probably increased near the dam where the retrogression increased the gradients at the ends of the tributaries. The dam eliminated floods from the river above it, and the duration of high velocities, which formerly existed during floods and moved the coarse material on down the river, was greatly reduced. The effect of this has been largely to offset the retrogression, and in places has actually raised the riverbed level.

The Laguna Dam on the Colorado River was completed in 1909 and raised the water level about 10 ft., forming a pond of perhaps 20,000 acre-ft. There was a large flood soon after the dam was completed, and within a few months the retrogression at Yuma, 22 miles downstream, had reached 3½ ft. (*Transactions*, Am. Soc. C. E., Vol. 76, 1913, p. 1214.) The pond was practically filled the first year. The retrogression largely disappeared after the pond was filled and the flow of silt was re-established. The river has a slope at this point of about 1.1 ft. per mile, and about 50 per cent of the material composing the streambed is less than 0.003 in. in diameter.

Observations in Germany

On the Saalach River near Reichenhall, Bavaria, the retrogression in eight years was sufficient to endanger seriously the safety of a pier of a railroad bridge 3 miles below the dam. Retrogression was also observed at Innworks, Upper Bavaria (*Bautechnik*, No. 53, 1931). As this dam consisted of gates with sills at riverbed level, much of the bedload passed through during floods, and the lowering was slight.

Conclusions

The results of observations on retrogression seem to agree with known laws of stream dynamics, and therefore some general principles may be outlined.

Since retrogression is the result of the stream recovering its normal load of solids after they have been reduced by the abnormal conditions existing above the dam, the larger the load normally transported by the stream, or the greater the proportion of it deposited in the reservoir, the more rapidly retrogression will take place. Since high transported loads are caused by steep slopes or fine material, these conditions tend toward high recession rates.

A large pond has the same effect, since it removes a greater part of the solids. When the pond is filled, the degradation ceases and normal conditions tend to be re-established. For each type of bed material and discharge condition there is a definite slope that is stable for a given supply of solid material carried. If all of the material is removed by the dam, this slope is flatter than if the removal is only partial. If, in the recession, sufficiently resistant layers are encountered to prevent the removal of more material under the existing slope and discharge conditions, the retrogression will cease. It is hoped that before many years the science of stream dynamics will have progressed to a point where the relation between the size of particle, stream load, discharge condition and slope will be sufficiently worked out to permit at least approximate quantitative estimates to be made. Until that time arrives, some rough ideas of what may be expected may be obtained from the data given herein, for which all the pertinent conditions are given so far as the available data will permit.

Possible use for flood control

Under favorable circumstances this phenomenon may be made use of for flood control, since a river may be induced to excavate its own channel by constructing a reservoir upstream to remove the transported solids. The Yellow River in China, for example, offers the favorable conditions of steep slope, fine material, heavy silt content, few tributaries and a reservoir site. Other rivers in northern China also should be studied to determine the practicability of this method of control of their floods.

It is hoped that the effects of the Boulder Dam on the Colorado River will throw light on the practicability of

such a method of preventing the disastrous floods in that river.

In addition to the references given, the writer is indebted to D. W. Mead, L. F. Harza, E. M. Burd, J. H. Jaemichen and H. J. Gault for data used in this paper.

Boulder Dam is being constructed under the direction of the U. S. Bureau of Reclamation. All the designing work and design studies are made under the direction of J. L. Savage, chief designing engineer.

All engineering and construction work is under the general direction of R. F. Walter, chief engineer, with headquarters at Denver, Colo., and all activities of the bureau are under the general charge of Elwood Mead, commissioner, with headquarters located at Washington, D. C.

Retrogression Experience in Wisconsin and Europe

Continuous Records Are Needed In the Study of Retrogression

By L. F. Harza
President, Harza Engineering Co., Chicago, Ill.

I WISH to contribute more detail with reference to the dam on the Wisconsin River to which Mr. Lane refers because of its lowering of 7.5 ft. in the past eighteen years.

It should be pointed out that a clear understanding of the rate of subsidence of tailwater below a dam can only be determined by an accurate record over a period of years of the river level below the dam at known discharges. Immediately upon construction of any dam on a sand or soft foundation the taking of accurate records of river stages and discharges directly below the dam should be inaugurated and preferably at two or three points farther downstream.

In the case of the Wisconsin River the records were not complete enough to draw accurate conclusions, but it was assumed, and I believe correctly, that it is only the extreme minimum elevations of tailwater which approach closely enough to controlling riverbed elevation to be significant in revealing any change in such control. In the absence of a knowledge of the discharge at each point on the tailwater record curve, the expedient was adopted of drawing a curve tangent to the lowest points of the eighteen-year tailwater record. By so doing, it was thought that this curve would be more nearly related to the stability of the streambed control and less related to an uncertain and unrecorded amount of water flowing in the stream at the moment.

The plant in question practically shuts down from midnight until early morning except to carry one or two units floating on the line at a gate-opening only sufficient to maintain synchronous speed. The period of shutdown is long enough to permit the river for several miles below the power house to drain down practically to its controlled elevation. The curve tangent to the low point of the tailwater record revealed that the subsidence of tailwater level had only amounted to about 0.5 ft. in the recent six-year period, or less than 0.1 ft. per year.

Acting upon this evidence, a search at dawn, following a shutdown of several hours, revealed a bed of boulders several miles down the stream occupying the entire width of the river channel and serving as a controlling feature for the extreme low condition. The stream had undoubtedly eroded several feet of sand overburden before uncovering this boulder bed, which has apparently nearly stabilized the minimum level for the past six years. Whether this stabilization proves permanent depends upon the depth and extent of the boulder bed, the size of boulders and the lateral expanse of the bed in the event of widening of the river channel.

Even though extreme minimum tailwater may have been stabilized by this boulder bed, this does not necessarily stabilize the river elevation for higher discharges that will be more greatly influenced by the hydraulics of the river channel as a whole, including width and slope. Nature, by contributing such a boulder bed does, however, add greatly to the practicability and to the reduction in cost of stabilizing the river channel at this point by bank revetments or other supplementary and artificial means, if economically justified.

Experience With Bed Degradation Below Dams on European Rivers

By Samuel Shulits
U. S. Bureau of Reclamation, Denver, Col.
(Former Freeman Traveling Scholar)

THIS BRIEF STATEMENT of some European experiences with degradation below dams in streams with a solids load and the views regarding this phenomenon are based on research conducted while the writer was associated with Professor Armin Schoklitsch in Brno, Czechoslovakia. An exhaustive treatment of this problem and the transportation of solids by streams will be found in Schoklitsch's "The Movement of Solids in Streams and at Dams" (Geschiebebewegung in Flüssen und an Stauwerken).

The slope of a given reach of river will decrease if its bedload decreases; if the "geschiebe," or material of the bedload, becomes finer; or if the discharge increases. In each of the above cases, it is assumed, of course, that all the other factors remain constant. These

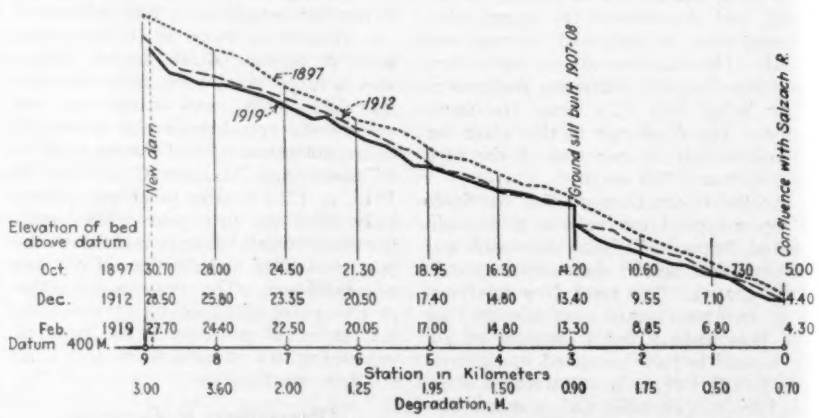


FIG. 1—DEGRADATION of the bed of the Saalach River in Bavaria is shown in this profile of the river downstream from the Reichenhall Reservoir, reproduced from "Der Wasserbau," Vol. I, p. 151, A. Schoklitsch.

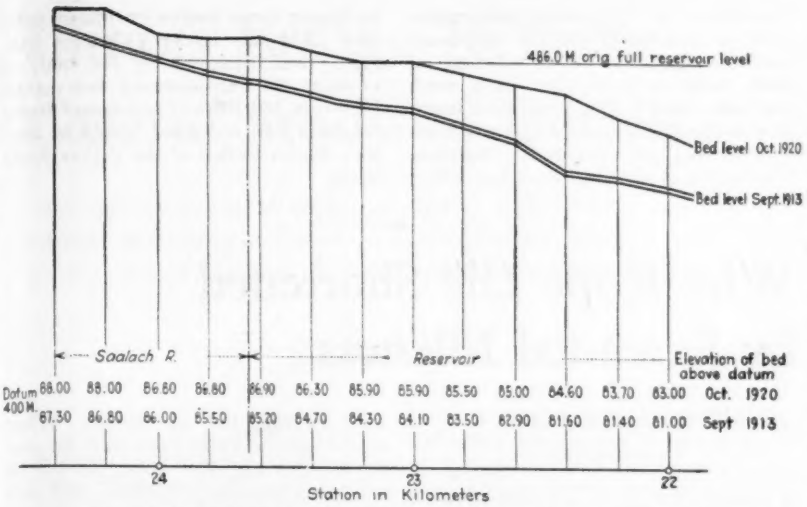


FIG. 2—AGGRADATION of the Reichenhall Reservoir, as shown in a profile reproduced from "Die Wasserwertschaft," No. 16, 1924, F. Schaffernak.

general principles apply also, though in a less defined manner, to the whole solids load—i.e., the suspended and bedloads.

Generally, all of the bedload and a portion of the suspended load will be deposited in the reservoir behind a dam, the amount of the latter being dependent on the size of the reservoir. Due to this depletion of the solids load, equilibrium will no longer exist between bedload, slope and discharge in the part of the river below the dam. The waters released from the reservoir will act to restore the initial equilibrium by picking up material from the riverbed. Degradation results, and in the end the profile of the riverbed has rotated downward about some point or control in the river where the water level is held constant. This control may be a downstream reservoir or dam, a ground or submerged sill erected expressly for this purpose or a rock ledge in the bed, or a lake, gulf or sea into which the river flows. An excellent example of degradation and the effect of controls is the profile of the Saalach River below the Reichenhall Reservoir, referred to by Mr. Lane, as shown in Fig. 1. The riverbed downstream from the dam receded almost 10 ft. in a little more than 21 years, or about 0.5 ft. per year.

Downstream from the outlet of a diversion canal the degradation will be more severe because of the increase in discharge. At the Uppenborn plant of the city of Munich, near Moosburg in Bavaria, Germany, the recession of the riverbed at the tailrace outlet caused an unexpected increase in head. (See O. Hartmann, *Die Bautechnik*, Vol. IV, No. 11, 1926, p. 134.)

Degradation of the river bed under such circumstances continues until the reservoir has aggraded or "silted" up completely. Subsequently the entire solids load passes over the dam. But, due to the diversion, the flow below the dam is inadequate for transportation of the entire load, and the stream will act to increase its bed slope to that required to carry the load with the lesser discharge. Aggradation will start just below the dam and proceed downstream to the canal outlet.

The degradation below the mouth of the canal continues, however, until the aforementioned aggradation reaches the canal outlet. When this occurs, the entire solids load is passing the outlet, and the downstream section of the river begins to aggrade.

The rise of the bed below the mouth of the canal decreases the slope of the riverbed between the dam and the canal outlet. There will be a slight tendency, therefore, toward aggradation in the river above the canal outlet in order to create the slope necessary for moving the load coming over the dam as the result of the silting of the reservoir.

The variation of flow in natural streams complicates the problem. Thus, high flows that remove a portion of the reservoir's deposits cause aggradation below the dam, while flows that drop their loads in the reservoir are followed by degradation below the dam.

If considerable fine material has subsided in the reservoir, it is believed that the degradation will become indiscernible at the point where the size of the grains has decreased sufficiently to permit their transportation also in suspension.

Recession of the bed level below a dam will increase the bedload of the tributaries, which may retard or check the degradation.

For completeness, the aggradation of the Reichenhall Reservoir is shown in Fig. 2.

The great interest in the morphology of riverbeds in Europe, India and this country arouses the hope that quantitative treatment of this problem may be possible soon.

Load-Recovery Theory Applied to Yellow River Flood Control

By Arthur M. Shaw
New Orleans, La.
Formerly Consulting Engineer to the Chinese National Government

MR. LANE has proposed a most interesting line of study and suggested a means of applying a well-known phenomenon of river hydraulics to the Yellow River problem. If, as stated, there is an available reservoir site, and if this site offers conditions of location, topography and capacity to warrant the necessary construction, the idea suggested of clarifying the waters of the Yellow River to increase their capacity for scour may well be worth a careful investigation. With his intimate knowledge of Yellow River floods and first-hand information covering considerable portions of the watershed of that unique stream, Mr. Lane is in a better position to judge as to the feasibility of a given plan than are those whose knowledge has been gained mainly through the reading of reports of others and through conversations with non-technical observers.

One wonders, however, whether the settling-basin idea will be as simple as it first appears. The principle seems sound, but it must be viewed from many angles. A basin will be required of sufficient capacity to retard the flow of a major flood, abstracting its load of silt and sending the waters on their way to work with increased vigor—and still retain in the basin, storage space for the silt of succeeding floods.

With a silt load said to amount to 4.5 per cent by volume, it is estimated that an ordinary high flood of the Yellow River carries something like 1,000,000 cu.yd. of solids per hour. It would not be reasonable to assume that the waters would be entirely clarified, or even that the entire floodflow would be passed through the settling basin, but we can readily imagine the rapid decrease in capacity of any reservoir which might be created and which would abstract any considerable portion of the silt carried by the Yellow River when in flood.

In addition to supplying a great detention reservoir, there will be many other problems that are, as yet, unsolved. These will relate to the time required for the water to discharge its cargo, and the increase in power of erosion afforded by clarification. Greatly in favor of the plan is the known fact

that, in spite of its extremely fine grain, the loess soil (which constitutes the bulk of the suspended load of the Yellow River) is precipitated with surprising rapidity in quiet water. Silt that has precipitated from gathered samples of floodwaters of the Yellow River, and specimens of soil from the delta have the appearance of clay, but the colloidal characteristics of clay are almost entirely lacking. Collected samples of floodwater, containing more than 5 per cent of solids, will have only a slightly milky appearance within a few minutes after being placed in a stationary vessel.

While considerable information has been gathered regarding the effect of velocity on the ability of the Yellow River to deepen its channel by scour, little has been learned regarding the effect of clarification. We may assume that the ability of any stream to scour its bed will be increased if the water is not already surcharged with silt, but what will be the rate of increase? Will the effect of clarification of the Yellow River waters be the same as with rivers flowing in a bed of different material? Can we assume that there is a marked difference in the scouring capacity, at a given velocity, of a clear-water stream and one that is carrying only one half its capacity? In this connection, it has been stated on good authority that samples taken from the Yellow River have shown as much as 10 per cent of solids. Or, possibly, the stilling basin will be brought into action only on a falling river, at which time channel-filling now begins and the silt content (per unit of flow) is at its maximum. Under such a method of operation, the tremendous scouring action of the present river, when in flood, would be utilized without reducing the silt-storage capacity of the reservoir—but it would require the construction of control works of the first magnitude.

The writer's knowledge of the disasters that follow floods of the Yellow River is too great, and his knowledge of the physical conditions of the river basin are too limited to permit an expression of opinion regarding the feasibility of the plan suggested by the author, but the plan has one marked advantage over others that have been advocated from time to time. Field surveys could be made quickly, and at a reasonable expense, from which it could be decided whether or not a suitable detention reservoir could be created; and the question of scour, transportation and deposit could be solved, with reasonable certainty, by laboratory experiments.

There is no hydraulic laboratory in China in which suitable studies could be made, but there is here presented an excellent opportunity for the engineers of this country to show, in a substantial form, their appreciation of China's problems and to extend a friendly hand. In the government-owned laboratory at Vicksburg (the existence of which we owe to the untiring efforts of the late John R. Freeman) there might well be undertaken the silt and scour studies suggested. The solution of such problems would aid in a work that was close to Mr. Freeman's heart. It was one of his great disappointments that he was not permitted to continue his studies of the Yellow River which he began some twelve or fifteen years ago. Not only is the Vicksburg laboratory well equipped for the study of erosion, silt transportation and deposit by rivers, but there is convenient to the laboratory an unlimited supply of loess soil, similar to that of the Yellow River basin.

Wire Rope Life Shortened by Extended Idleness

By Frank W. Bemis
Wire Rope Engineer, American Steel & Wire Co., Pittsburgh, Pa.

IN THE MANUFACTURE of wire rope each individual wire is carefully tested, accurately gaged, allocated to a definite place in the strand and thoroughly lubricated. The strands so formed are laid around a lubricated hemp core and, where necessary, the rope is given a further external coat of lubricant in the final operation. Unless the original lubrication is renewed at regular intervals, a wire rope will deteriorate by corrosion of the steel and absorption of moisture by the hemp center.

The need for proper care and lubrication is particularly important when it becomes necessary to shut down the equipment for an extended period. Idleness of wire rope during the period of its service will tend to lessen its serviceability more or less, even if the best of care is exercised. Ropes treated with good care will not equal the service rendered by ropes that are kept in continuous service without idle time.

Precautions should be observed to care for rope not in service. When equipment is shut down for an extended period, the rope should be cleaned, dried and lubricated, and also protected from exposure to outside elements such as water or vapors. This can best be accomplished by storing the rope in a dry warehouse after treatment. Even though the storage procedure is impossible, the rope treatment should be carried out.

FIG. 1—A 1-in. mine rope, used on a well-drained bore hole slope, broke the second day after a five-month shutdown.

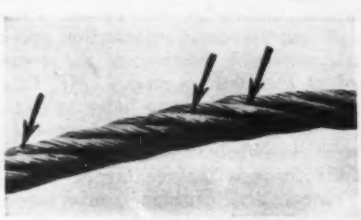


FIG. 2—A 1⅛-in. mine rope used on a wet underground slope broke the first day after a two-weeks' shutdown. Acid mine water washed off the lubricant.

The cuts illustrate the appearance of two wire ropes that broke shortly after they were put back into service following a temporary shutdown. After the rope shown in Fig. 1 had been in service less than half its normal life, the mine was shut down for five months and the rope stored on the drum in the engine room. Two days after operations were resumed the rope broke. An analysis showed that the center had begun to deteriorate and all the wires were badly corroded. The inside wires of the strands were so severely corroded that they could not properly support the outer wires. The result was a bridging of these outside wires, as shown by the arrows in the photograph. Note the pitted condition of the wires and the lack of lubrication.

After the rope shown in Fig. 2 had been in service thirteen days, the mine was shut down for only two weeks. The first day that operations were resumed the rope broke while a car of rock was being lowered. An investigation disclosed that while the rope was stored on the drum, in the comparatively hot underground engine room, mine water had dropped on it in three different sections, dissolving the outer wires and leaving the inner wires badly pitted, as illustrated in the photograph. An analysis showed that this mine water was highly acidic, having a pH value of 2.8.

These illustrations strongly emphasize the necessity for careful examination and inspection of ropes before they are again placed in active use. This examination can best be made by cutting samples from the rope, if it can be done without spoiling the main length for actual service. Then the sample should be dissected for examination both externally and internally. This is usually possible without delaying operations.

Illinois Bridge Reflects Careful Study of Details

Through-cantilever structure of 500-ft. span over Illinois Waterway at Ottawa, Ill., planned for simplicity of framing and ease and speed of erection

By Gunni Jeppesen
Bridge Engineer, Illinois Dept. of Public Works and Buildings, Division of Waterways, Joliet, Ill.

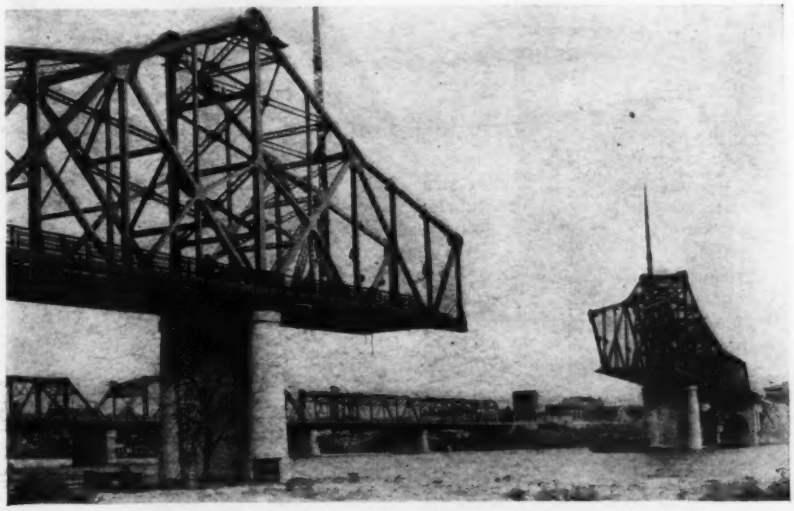


FIG. 1—NEW CANTILEVER BRIDGE of 500-ft. span at Ottawa, Ill., replaces the old short-span bridge downstream, which is being demolished.

IN PLANNING and constructing the new bridge over the Illinois River (a part of the Illinois Waterway) at Ottawa, Ill., more than usual attention was paid to details in an effort to achieve efficiency and economy. Known as the Hilliard Bridge, it is a cantilever highway structure, 1,000 ft. long from end to end, with a 500-ft. main span and 250-ft. anchor spans, and provides a clear headroom for navigation of 47 ft. The bridge, which carries a 24-ft. concrete roadway and two 5-ft. sidewalks of light-weight concrete slabs, is located about 250 ft. upstream from the LaSalle St. Bridge, which it replaces and which is now being demolished. The river piers are of dumb-bell type and are founded on rock. The south abutment is a buried abutment, while the north abutment is of skeleton type with curtain walls extending from column to column, to produce the effect of a three-span arch. Approaches consist of earth and sand fills, and on the north side of the river provide access to the bridge both from LaSalle St. and Columbus St. (Fig. 2) by means of a wye, in the fork of which the city of Ottawa is planning to build a new city hall.

FIG. 2—PLAN AND ELEVATION of Hilliard Bridge. A new city hall for Ottawa, Ill., will be built within the north wye approach.

The Hilliard Bridge is part of the Illinois Waterway bridge program, which has been in progress for the last two or three years under the state division of waterways. This division on July 1, 1933, was transferred to the department of public works and buildings, from the department of purchases and construction which was abolished by act of the legislature.

The total cost of the bridge was $364,000 divided as follows:

Substructure	$ 90,000
Superstructure	183,000
Approaches	91,000

The project was financed partly from the proceeds of the $20,000,000 bond issue for the construction of the Illinois Waterway and partly from state highway funds, while the city of Ottawa shared in the cost in return for certain special features that were embodied in the design at the city's request and for placing the bridge at a new location instead of on the site of the old bridge.

The bridge is designed for an H-20 loading under the A.A.S.H.O. specifications of 1928, with some modifications. The main truss members are of silicon steel. Secondary truss members and floor system are of carbon steel.

Superstructure design

In preparing the design of the superstructure a careful study of details was made with a view to securing simplicity and direct stress transfer, as well as ease and economy of fabrication. Features adopted include:

(*a*) Floor beams framed normal to grade line, thus eliminating bevel cuts on stringers and bevel fills at connections of floor beams to trusses.

(*b*) All floor beams framed full depth into trusses with tension ties at ends to carry sidewalk bracket loads.

(*e*) Special attention to floor details, both steel and concrete, at all expansion joints.

(*d*) Careful selection of chord sections so as to simplify the connections and splices and eliminate fills as far as possible. Fills thinner than ¼ in. were avoided.

(*e*) All truss members, including compression chords, fully spliced.

(*f*) Symmetrical sections for compression members involving a central, longitudinal, diaphragm or web, for all portal columns and for heavier members —i.e. bottom chords from L-6 to L-14, and main posts.

(*g*) Special attention to lacing details of compression members, with transverse ties at all lacing panels. Where lateral loads are carried into a column through portal action, these loads are added to the shears specified for the lacing of ordinary columns.

Provision was also made, in the preparation of the plans, for securing speed and ease of erection. Features adopted include:

(*a*) Survey of actual position of anchorage pins after abutments had been constructed, before boring pinholes in truss rockers at points L-0.

(*b*) Prestressing live-load anchorage eyebars to avoid pounding at this point due to uplift.

(*c*) Requirement that bearing slabs, truss shoes and floor beams at main piers be all assembled and adjusted to proper line and level by means of heavy leveling screws, before being concreted in.

(*d*) Use of pin joints at ends of spans, and avoidance of telescoping joints.

(*e*) Drilling connection holes, for expansion joints at ends of spans, in the field.

(*f*) Use of hydraulic jacks in both top and bottom chords at ends of suspended span for closing main span.

(*g*) Provision for adjusting lengths of sub-ties at middle of main verticals at piers, after roadway slab had been placed, to avoid possibility of pulling these members out of line.

The bridge is provided with standard wheel-guards on the inside of the trusses (Fig. 3). At the same time each sidewalk has two substantial railings both of which are outside the trusses, thus leaving the space occupied by the trusses entirely open for inspection and painting and avoiding the complicated details that are encountered when the truss members pass through the sidewalk slab.

Each sidewalk is built of two light plate girders, resting on cantilever brackets. The sidewalk itself is made up of 4x5-ft. precast slabs of lightweight concrete (burned clay aggregate) spanning from girder to girder and having lifting holes so that they may be conveniently removed and replaced as required. The slabs are 3½ in. thick and weigh 30 lb. per sq.ft. They were factory-made, and vibrators and steam-curing were employed in their manufacture. The sidewalk girders, with ties below and the slabs above, form what amounts to a trench in which gas and water mains, power and light cables, telephone cables, fire-alarm cables, etc., are carried.

FIG. 3—JUNCTION of suspended span with cantilever arm. Major part of expansion is provided for at this point. Note the curb and railing details and the use of pin joints.

Cast-steel, finger expansion joints, which insure complete freedom for movement due to temperature and load, are provided in the roadway slab at the abutments and at one end of the suspended span. Intermediate expansion joints are provided in the floor and walks every three or four panels, to relieve the floor system of racking due to chord deformations under load.

Fabrication and erection

In fabricating the steel for the bridge all rivet holes in main truss members were drilled from the solid. Bottom chords of the anchor and cantilever spans were assembled in the shop in a straight line, and holes for field splices were reamed in this position. Each truss was assembled complete as a unit in the shop, and field connections were reamed or drilled.

The specifications provided that the contractor, before proceeding with erection, should work out a detailed construction program meeting the approval of the engineer. This was done and, by disposing of many important questions before the work was started, promoted speed in the field work and harmony between the forces of the state and the contractor.

Cantilever erection was employed as far as possible. Two bents of steel falsework were used under each anchor span, and none at all under the main span. Steel wedge jacks were used under the falsework posts, which made it possible to adjust easily and quickly the elevation of the truss to any desired point and hold it there.

Bottom-chord splices of anchor and cantilever arms were riveted at a stage of erection when these chords were nearly in a straight line, thus eliminating most of the secondary stresses that otherwise might have occurred at these points.

Rivet forges were operated by compressed air, thus securing steady heat with a minimum of trouble.

Personnel

The substructure and approaches were built by the MacDonald Engineer-

ing Co., Chicago, with the Congress Construction Co., Chicago, as subcontractors for the piers and abutments. The superstructure was fabricated and erected by the Wisconsin Bridge and Iron Co., Milwaukee.

All designing and supervision was in the hands of the engineering staff of the division of waterways: the late L. D. Cornish, chief engineer (resigned July 20, 1933); Walter M. Smith, assistant chief engineer (since July 20, 1933, acting chief engineer); and the writer as bridge engineer.

J. H. Walker, division engineer, was in charge of field operations. F. A. Coy supervised the construction of the substructure and the approaches, while L. T. Wyly was resident engineer on the superstructure. The concrete aggregates were inspected and the concrete proportioned and inspected by the division's field-testing laboratory, in charge of J. J. Collins.

Models As Aids In Design and Construction

Two-day conference at S.P.E.E. meeting in Ithaca, N. Y., reviews a rapidly expanding art in the fields of structures and hydraulics and introduces some new developments

THE CONFERENCE on the laboratory uses of models in structures and hydraulics held June 19-21 at Cornell University in connection with the annual meeting of the Society for the Promotion of Engineering Education proved quite as successful as advance notices indicated it should. The first conference of its kind, attendance was nationwide. Several hundred were present at each session. Speakers were well-known specialists in the field of models, both as used for teaching and as adjuncts to design. And the program was as varied and complete as the time available in the 2½ days would permit. The general chairman of the meeting was Fred L. Plummer (Case School of Applied Science), Cleveland. He was assisted in arranging the program by E. K. Timby (Princeton University); by F. W. Slantz (Lafayette College) in the field of structures; and by K. C. Reynolds (M.I.T.) and E. W. Schoder (Cornell) in the field of hydraulics. Also, G. E. Large and R. W. Powell (Ohio State University) arranged for a large group of exhibits of model apparatus and results. Local arrangements were handled by Professors E. N. Burrows, H. H. Scofield and C. L. Walker, all of Cornell.

The structural model program divided itself rather logically into three principal divisions: (1) consideration of the deformeter method of model analysis; (2) principles and possibilities of the photoelastic method, and (3) loaded models, including suspension bridges, dams and buildings. The hydraulic program covered the equipment of the hydraulic experimenter, the hydraulic laboratory as an aid to the student and small-scale studies of sanitary engineering problems.

In his opening remarks Professor Plummer reviewed some of the reasons why model studies have expanded and developed so rapidly during the past decade, and he pointed out one very important attribute of model studies—namely that they give the designer a "feel of the structure." Some of the developments that have combined to create interest in the use of structural models are the growing popularity of continuous types of structures for which theoretical analysis may be difficult, tedious, or almost impossible; the design of structures of unprecedented size requiring development and checking of theory, and careful research as to comparative designs and changes in secondary parts of each design; and recognition of the importance of stress concentrations and the usefulness of models for demonstration and instructional uses. Professor Plummer in describing the conference said that it was not interested in detailed results of any specific model study, but rather was concerned in fostering a thorough understanding of the fundamentals of similitude, of the basic principles of each of the various methods of model analysis, and of the present state and future possibilities of model work.

As a preliminary to the special session, the first general session, in addition to Professor Plummer's paper, contained a most significant elementary discussion of the laws of similitude by Roy W. Carlson (University of California). This paper will be published in full in a future issue.

The deformeter method

Three papers considered the deformeter method of model analysis, Hale Sutherland (Lehigh) presenting a historical perspective and the fundamental principles, J. Trueman Thompson (Johns Hopkins) illustrating typical structural problems, and Carroll L. Mann, Jr., of Raleigh, N. C., describing a study of a multiple-span concrete-arch bridge in which the best technique in the design and construction of models was outlined.

Professor Sutherland, as an introduction to his paper, listed five American contributors to structural theory (which he pointed out is largely the achievement of Europeans) in the persons of Squire Whipple, truss analysis, 1847; C. E. Greene, moment-area theorems, 1872; G. A. Maney, slope-deflection method, 1915; George E. Beggs, deformeter method of model analysis, 1922; and Hardy Cross, methods of column analogy and moment distribution, 1926. He paid particular tribute to Professor Beggs for his development of the accurate mechanical solution of statically indeterminate structures by the use of models and gages, pointing out that the method was a contribution to the theory and practice of stress analysis "not surpassed by any single contribution of any other investigator." Professor Sutherland then proceeded to develop the history of the various basic laws upon which the deformeter method of model analysis is based. Space does not permit reviewing this development, but it is proper to recall that in applying the Beggs method to the determination of the reactions of statically indeterminate planar frames, a model of the structure, elastically proportioned in all parts to the prototype, is fastened to a drawing board by "deformeter gages" at the points of support, these gages being so contrived that a small movement of known magnitude in either thrust or shear or twisting may be given to the point of support. The movement is read with micrometer microscopes, and the resulting deflection curve is an accurate influence line.

There are disadvantages to the small movements with the Beggs apparatus, and Professor Thompson in his paper mentioned a recent modification originated by William J. Eney, who, by making the gages larger and capable of exerting much greater deformations, has increased the resulting deflections so as to make them readable with an ordinary machinist's micrometer.

The Gottschalk "Continostat" is another deformeter apparatus, consisting essentially of a straight-edge upon which are mounted knife-edge supports for steel splines. The knife-edge supports are susceptible of movement both along the straight-edge and at right angles thereto. The splines bend into the shape of the influence diagrams for reactions and shears, and moments may thus be determined. A modification was also mentioned of the Continostat devised by Anders Bull, in which brass drill rods are soldered together to form

the model (*ENR*, Dec. 8, 1927, p. 920). Professor Thompson concluded that the Beggs apparatus lends itself to all sorts of intricate applications and offers the greatest accuracy of any of the available methods, but it is higher in cost and requires models produced with greater trouble and involves the use of microscopes, which is tiring, laborious and time-consuming. The Eney modification, referred to above, eliminates some of the disadvantages. The Continostat does not require the use of microscopes and is therefore considerably cheaper. It is faster and less tiring, but it possesses a serious defect in that it does not lend itself well to model fabrication if the structure is at all complicated. The Bull modification reduces costs and eliminates the serious difficulties met with in model fabrication. As an interesting application of Beggs gages, Professor Thompson mentioned how he had used them to illustrate the Freyssinet method of decentering and stress adjustment of concrete arches.

In building planar models for use with the Beggs deformeter system, Carroll L. Mann, Jr., listed the following points on technique: use a clear-grade celluloid specially seasoned for a period of weeks at elevated temperature; cut all pieces for the model from the same or nearly identical sheets of celluloid, otherwise a variation of Young's modulus may be expected; cementing material such as acetone or celluloid cement should be used sparingly in making joints in order that the celluloid sheet may not be made plastic by the solvent in the cement; mount the model on a base that will minimize the effect of warping and insure a plane working surface; take proper care to maintain constant temperature by not exposing the model to drafts of air, direct sunlight, intermittent on varying illumination; a good procedure is to use 100-watt electric lights supported in a row about 3 ft. above the model and to have them illuminated about a half hour before deflection readings are taken.

Photoelastic methods

Photoelasticity as a means of stress analysis was considered in several papers, the principles of the method being outlined by Thomas H. Evans (Yale), the place of photoelasticity in engineering instruction by Max M. Frocht (Carnegie Institute of Technology), and its use in graduate research by George B. Karelitz and Raymond D. Mindlin, of Columbia University.

The photoelastic method is based on the effect of a stressed transparent model on a beam of polarized light and so far has been limited largely to two-dimensional problems. Polarized light passing through a stressed bakelite model produces a pattern of maximum shear stress contour lines on a screen, these contour lines when bunched closely together indicating areas of stress concentration. The values in pounds per square inch of these lines or fringes may also be determined. The photoelastic method gives the difference between the two principal stresses at a point. Determination of the components separately is difficult and comprises the chief disadvantage of the method.

Professor Frocht's paper was designed to show the reliability of the photoelastic method and to point out how it may be used to impress students with the fact that the basic assumptions used in elementary strength of materials are not always true. For example, Dr. Frocht demonstrated how photoelastic records may be used to illustrate that axial loads do not always produce uniform stress distribution, that longitudinal stresses in bending do not always follow a linear law, that the horizontal and vertical shear stresses in beams often deviate markedly from a parabolic law of distribution and that the strength of a member does not necessarily increase with its dimensions. He also pointed out that, in addition to providing a means for the determination of the maximum shear stresses at any point in a body, photoelasticity provides an effective tool for the immediate evaluation of stresses at free boundaries and thus is an excellent tool for the study of stress concentrations at fillets, notches, holes or other discontinuities. Stress patterns also permit the determination of the direction of the principal stresses at any point of a stressed body or model.

In demonstrating the reliability of the photoelastic method Dr. Frocht showed how the actual vertical shears checked photoelastically-determined shears at 56 sections at 5 different beams varying in dimensions and loads and how the longitudinal stresses at 8 sections of a 4:1 beam satisfied the laws of equilibrium. That the use of bakelite or other material instead of steel is not a particular shortcoming of the method is indicated by comparisons of strain measurements of steel models with photoelastic results, and by comparing photoelastic results with stress distributions determined from the mathematical theory of elasticity.

In discussing Professor Frocht's paper L. E. Grinter (Texas A.&M.) warned against the danger of becoming too interested in the fascinating process of photoelasticity to the end that the results sought after may become secondary. He also emphasized the difficulties inherent in using bakelite models since the elastic properties of the material are not comparable with the elastic properties of steel above the elastic limit where the high concentrations of stress occur in which we are interested. M. F. Sayre (Union College) pointed out that, while above the elastic limit the photoelastic method as well as the mathematical method of the theory of elasticity become inaccurate due to plastic flow, in most cases the error lies on the side of safety, particularly for steady stresses. Plastic yield, although it reduces the maximum stress under steady load, ordinarily does not change the stress range under variable loads so that photoelastic methods are likely to give more accurate results in prophesying fatigue failure than in prophesying failure under a steady load. Professor Sayre believes that where stress concentrations are separately allowed for, as with the photoelastic method, higher working stresses should be permissible.

New photoelastic developments

In his paper on the use of photoelastic methods in graduate research, Professor Karelitz outlined several problems to indicate the value of the method in experimental analysis of stress distribution and concentration in details which could not be investigated conveniently or at all mathematically. One of these investigations, of particular interest, involves an apparatus developed by Prof. Philip B. Bucky of Columbia. The apparatus is a large centrifuge in which forces equal to about 3,000 times gravity can be obtained. By whirling a model retaining wall of bakelite mounted between two glass plates, the sand that fills the centrifuge is acted upon by centrifugal force, reproducing the actual loading on the full-scale structure. A powerful stroboscopic light flashes once a revolution when the model is in line with two windows in the centrifuge housing. A polariscope is mounted to observe the stresses in the bakelite model, the stroboscope permitting photographing of the stress fringes.

A second new development in photoelastic studies was presented by Raymond D. Mindlin, also of Columbia, involving two parallel systems of plane stress as in the case of overlapping plates in side-welded connections. For investigating bakelite assemblies of such welded lap joints a new type of polariscope was developed in which the light, after passing through the usual arrangement of polarizing prism, retardation plate and model, is reflected directly back through the same system. This is accomplished by inserting a mirror between the main plate and the lap plate. The light passes through the lap plate, strikes the mirror and is reflected back through the lap plate. The resulting picture that is thrown on the screen thus has twice as many fringes and may be considered twice as accurate as the usual case where the light passes directly through the model only once.

Professor Mindlin also described the method suggested by the late Professor Mesnager which would permit the determination of the extreme fiber stress distribution produced in a plate by forces applied at an angle to the plate. (At present photoelastic research is limited to uniplanar stress distributions produced by forces applied in the plane of the stress). Professor Mesnager's suggestion was to coat a polished slab with a thin layer of transparent material, which becomes doubly refracting when

strained. Bending the plate out of its plane strains the coating, and the resulting double refraction is measured by analyzing polarized light reflected by the metal surface. Many problems in the bending of plates and flat slabs could thus be analyzed with the reflection polariscope. There is at present no suitable transparent material which would make this process feasible. The new polariscope can also be used without modification in the interference method of determining the sum of the principal stresses, it being noted that the usual photoelastic process gives the difference of the stresses. With both the sum and difference available, the values of the component stresses are easily found.

Classifying models

In a paper in which the avowed intent was to present a general picture of the structural model field, H. J. Gilkey (Ames) developed a classification that is interesting and informing. He assumes that models are devices for studying the behavior of a structure as distinct from specimens that are used to study the material only. There are demonstration models and research models, and Professor Gilkey's classification covers only the latter, which he further identified as "loaded models"; he extends the meaning of the latter term to include also the various analogies that have been developed. The classification, with a few examples, follows:

Classification of models

I. Similar models (satisfying the requirements of similitude).
  A. Elastic.
    1. Displacement models (for measuring strains, deflections and rotation, using gages, dials, extensometers, mirrors, etc.).
      (a) Mono-axial stresses (pin-connected bridges, arches, ordinary beams, one-way slabs and some columns).
      (b) Biaxial or triaxial stresses (two-way slabs, spiralled columns, dams, parts of trusses, etc.).
    2. Photoelastic models (of celluloid, bakelite or glass; planar problems largely, although some three-dimensional problems have been successfully solved).
    3. Brittle material models (tested to failure and analyzed by using stresses computed from a simple specimen of the material also tested to failure).
  B. Non-elastic models.
    1. Displacement models (such as concrete columns tested for time yield and plastic flow).
    2. Slip line models (Lueder's lines, showing stress concentrations, usually on a polished metal surface or on a paraffine coating).
    3. Brittle paint models (Lueder's lines in portland cement grout or similar coating material).

II. Dissimilar models (methods of analogy involving the mathematical relationship between stress conditions and the action of various types of models).
  A. Elastic analogies.
    1. Membrane or soap-film analogy based upon the fact that there is a direct relation between stress intensity in a specimen and the slope of the surface of an elastic membrane of the same boundary shape as the cross-section of the specimen.
    2. Hydro-dynamical analogy (relation between the equations of motion of a frictionless fluid and the stress distribution in a twisted bar of circular cross-section and variable diameter).
    3. Electrical analogy (relation between the distribution of torsional stress in a shaft of variable diameter and the distribution of electric current in a plate of variable width and thickness).
    4. Slab analogy (relation between the stress function for a slice of a structure and the shape taken by a distorted elastic slab).
  B. Plastic analogies.
    1. Sand-heap analogy (relationship between the shearing stress distribution in a bar twisted so all parts are stressed to the yield point and the shape taken by a heap of fine sand placed upon a plate of the same shape as the cross-section of the bar).

Several illustrations of loaded models, particularly for classroom demonstration, were cited in the paper by J. Charles Rathbun (College of the City of New York). One is an arch made of wood blocks strung on wires. Application of a concentrated load shows arch action clearly, while under a distributed load the manner in which the arch adjusts itself is made apparent. Models of frames, bents, arches, etc., cut from heavy flexible rubber pads, can be deformed to such an extent that the qualitative distribution of stress may be plainly shown; the strains in a beam may be visually produced by similar rubber models.

Suspension bridge models

Starting with the Mount Hope Bridge and culminating, for the present, with the San Francisco-Oakland Bridge, models have played an important part in the design of modern suspension bridges. George E. Beggs (Princeton) briefly reviewed his notable investigations of these models, outlining the methods of design, construction and testing as given previously in his article in *Engineering News-Record*, June 9, 1932, p. 828, and in the University of California *Publications in Engineering*, Vol. 3, No. 2. The problems of the Golden Gate Bridge tower tests were also covered by Professor Beggs. This model of stainless steel was completely three-dimensional and is the first exact replica of a structure to be subjected to scientific test (*ENR*, Jan. 25, 1934, p. 125).

In discussing Professor Beggs' paper Charles M. Jones (John A. Roebling's Sons Co.) emphasized the importance of suspension bridge models to the contractor, citing their use in determining an efficient storm cable system for the catwalks of the George Washington Bridge, in selecting a method and the equipment for hoisting the catwalk ropes to the tops of the towers, and in studying saddle motions during cable spinning. Mr. Jones also mentioned how the Sky Ride at Chicago was the result of model studies of various cable systems.

Dam studies

The extensive model testing of the Bureau of Reclamation in connection with various dams was outlined in a paper by J. L. Savage which was read by Professor Gilkey. The Bureau used concrete in its 1:68 model of Gibson Dam and loaded it with mercury instead of water in order to secure measurable deflections. The 1:240 model of Boulder Dam and other models have been made of a mixture of 1 part plaster, $\frac{1}{2}$ part Celite and $1\frac{7}{8}$ parts water, which has proved very satisfactory, mercury again being used for loading. (See article by J. L. Savage and Ivan E. Houk, *ENR*, April 7, 1932, p. 494.) A 1:180 rubber-litharge model of Boulder Dam was also tested, but with rather unsatisfactory results because of the low Poisson's ratio of the rubber litharge.

One of the recent new developments is the testing of slices or sections of dams as contrasted to complete models. These tests, performed on plaster-Celite sections of Boulder, Grand Coulee and Norris dams, have proved useful in determining load deflections, general stress conditions and special stress conditions at corners, around galleries, etc., but are questionable for foundation stresses because of the necessity for using rigid framework to support the models.

An interesting detail of the set-up for testing dam sections is the method of increasing the effective dead load. The live load of mercury being 13.6 times as heavy as the water load on the prototype, it was necessary that the dead load be increased in the same ratio. This was accomplished by lead weights acting through levers at the bottom of the supporting frame. The levers were connected by wires to steel pins extending through the dam model, and the amount of load applied to each pin was made proportional to the volume of material around the pin.

On the Boulder Dam section model the live load, as determined by the trial load analysis, was applied mechanically (instead of with mercury) by means of a system of weights attached to wires running over pulleys to bearing plates on the upstream face of the model.

Buildings

Study of building behavior under earthquake loadings has been under way at Stanford University during the past eight years, using models on a shaking table. Professor Arthur B. Domonske presented a paper prepared by Lydik S. Jacobsen describing some of this work. The difficulties were pointed out of finding materials for models that will satisfy general similitude requirements for buildings that are composed of a variety of materials. The models used, therefore, do not pretend to produce stress similitude (since stresses can easily be computed when dynamic loads are known) but concentrate on an accurate dynamic distortion similitude. The paper described a 26-story model that has been tested. By making weight and rigidity scales the same, model and prototype have the same free vibration periods. The weight of a story was considered concentrated at floor levels, and each floor was made of a steel plate, horizontal rigidity being represented by sets

of horizontal helical springs connecting a plate with its two adjacent plates. Vertical ball-and-pedestal spacers separated the floors. In using the model, dynamic displacements produced by several kinds of forces were recorded and, from these, dynamic loads and stresses computed. The above applies specifically to short stubby buildings. For slender structures the vertical rigidities are also taken into account by means of vertical helical springs placed between each story.

The soap-film analogy

Although Professor Gilkey listed numerous analogies in his classification of models under the heading of dissimilar models, only one paper considered this interesting field. This was an outline of the soap-film analogy and a description of its use of torsion in structural steel beam sections by Bruce Johnston (Lehigh).

Hydraulic models

The papers on hydraulic models were largely devoted either to completed work, already reported in various places, or to teaching technique and hydraulic laboratory practices. They therefore do not have the widespread interest of the structural model discussions. On the other hand, a paper by Ralph W. Powell (Ohio State) on "Dimensional Analysis as Related to Hydraulic Model Studies" comprised a notable introduction to the mathematics of hydromechanics; to the universal importance of Froude's Number (V^2/gD) which must be the same in model and prototype; to the relative unimportance of Reynolds' Number, since viscosity is usually not a factor; and to distorted models such as are used for river studies.

Specific model studies described by various speakers were those of the Mississippi River at the U. S. Waterways Experiment Station at Vicksburg, by Lt. K. D. Nichols; of the roller-gate and other river dams at the Iowa Institute of Hydraulic Research by F. T. Mavis; of various power dams in New England and elsewhere at the Worcester Polytechnic Institute by C. W. Hubbard; and of the proposed Mt. Morris Dam of the Rochester Gas & Electric Corp. at the Cornell hydraulic laboratory by E. W. Schoder.

In the session on small-scale studies of sanitary engineering problems, two papers were given—namely, studies of filter sands by G. M. Fair (Harvard University) and hydraulic analysis of water-distribution systems by the use of an electric network analyzer, by T. R. Camp and H. L. Hazen (M.I.T.). These papers will be presented in more detail at the forthcoming meeting of the New England Water Works Association.

Letters to the Editor

Discharge of Tainter Gates

Sir—Mr. Horton's article (*ENR*, Jan. 4, 1934, p. 10), on discharge coefficients for tainter gates, gives much needed data to the hydraulic engineer. However, it seems he is not consistent with present-day practices when he advocates measuring the head on tainter gates to the center line of the opening.

Mr. Etcheverry in his book "Irrigation Practices and Engineering" (Vol. II, p. 72), summarizes tables from Parks' "The Control of Water," and there states that the head is measured from the upper edge of the gate.

King's "Handbook of Hydraulics" gives the formula $Q = CA\sqrt{2gh_o}$ for gates or sluices where h_o is the difference in water level for submerged, or partially submerged, flow condition.

In an article by J. S. Longwell and Julian Hinds, appearing in the *Reclamation Record*, October, 1919, it is stated that h_o is the effective head, and furthermore that the coefficient of discharge should be based on either the head on top of the gate, including velocity head, or on the drop through the gate, including velocity head. Koch and Carstanjen's equation takes care of the velocity head in their coefficient.

The nature of most formulas in hydraulics is that a theory is developed, and then by experiments a coefficient is obtained. Now if the theories differ, correspondingly different coefficients will be obtained. For example, the head on a weir might be measured from the center line of the nappe above the weir crest to the water surface. That is, the head would be just one half the head commonly used, the coefficient would be changed in value ($2^{\frac{3}{2}} \times$ common coefficient), but by using this coefficient the same discharge would be obtained.

Special effort is being put forth to standardize hydraulic symbols and formulas so that articles may be more easily read and coefficients of various formulas may be compared. It is gathered from most books and articles that the correct head to use would be the effective head, which would take into account the flow conditions below the gates. However, for tainter gates, the water below the gates usually does not rise above the elevation of the lip. Also in design work the flow condition below the gate is often difficult to estimate or compute.

The writer has modified Koch and Carstanjen's equation so as to give K in the formula:

$$Q = KA\sqrt{2gh_o}$$

where h_o is measured to the top of the opening.

If D = depth of water upstream from gate, W = height gate is raised, and N = depth ratio = D/W.

The relation between the C in Horton's formula $Q = CA\sqrt{2gh_e}$ where h_e = head to center line of opening, and K in the formula where $Q = KA\sqrt{2gh_o}$ is

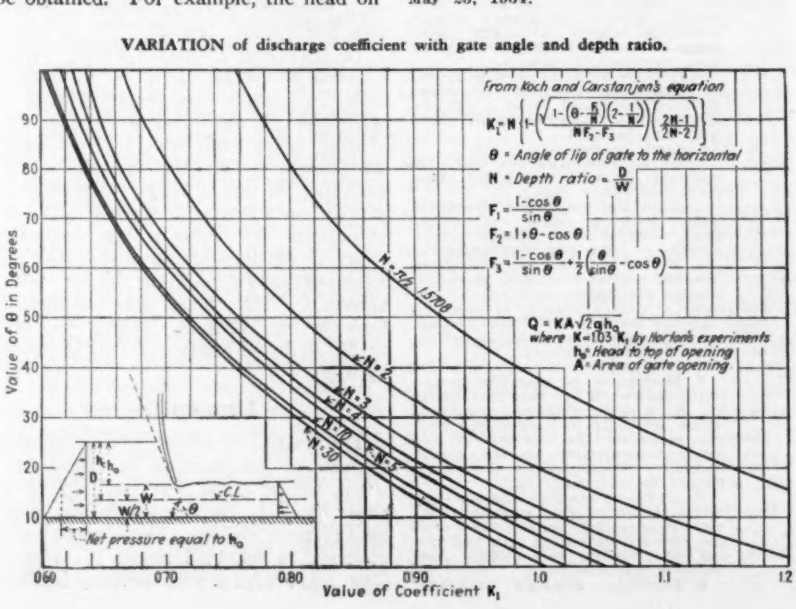
$$K = C\sqrt{\frac{2N-1}{2N-2}}$$

The accompanying diagram is similar to Mr. Horton's, except that the head is measured to the upper edge of the opening, and the value of the coefficients has been changed to agree with this head.

WHITNEY M. BORLAND,
U. S. Bureau of Reclamation.

Denver, Colo.,
May 23, 1934.

VARIATION of discharge coefficient with gate angle and depth ratio.


From Koch and Carstanjen's equation
θ = Angle of lip of gate to the horizontal
N = Depth ratio = D/W
Q = KA√2gh_o
where K = 1.03 K_1 by Horton's experiments
h_o = Head to top of opening
A = Area of gate opening
N = ∞
N = 2
N = 3
N = 4
N = 10
N = 30
N = .5
Value of θ in Degrees
Value of Coefficient K_1
Net pressure equal to h_o

Book Reviews and Notes

A Monthly Commentary on Current Additions to the Civil Engineer's Library

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A Quarter Century of Technical Book Publishing

With what we hope is a pardonable amount of parental pride, *Engineering News-Record* records in these pages devoted to the review of civil engineering literature the 25th anniversary of the organization of the McGraw-Hill Book Co. On July 1, 1909, the book department of the Hill Publishing Co., publishers of *Engineering News,* was combined with the book department of the McGraw Publishing Co., publishers of *Engineering Record,* to form the McGraw-Hill Book Company; and the new company took over the book publishing operations of the two publishing houses that in turn had been taken over by them in acquiring the several technical papers they were then publishing. Eight years later the two publishing houses were combined to form the McGraw-Hill Publishing Co. At the latter time *Engineering News* and *Engineering Record* were combined to form the present journal. The book company, therefore, while only 25 years old, is carrying forward the book publishing activities begun by the antecedents of *Engineering News-Record* a half century ago. Beginning in a small way by reprinting a series of articles or a group of related articles in convenient book form, work that was carried on by the editorial and business staff of each paper, the business developed first into separate departments of the two publishing houses and then into the separate company that during the past year, despite trying business conditions, brought out 136 new books, including 27 revised editions. In more recent years the field has been expanded to cover all principal scientific and engineering subjects and, since 1930, non-technical discussions of technical, scientific and economic subjects through the publications of Whittlesey House.

Arch Dam Design

ARCH DAM INVESTIGATION, VOL. II.—Cloth; 6x9 in.; pp. 542; diagrams, tables and photographs. Published by United Engineering Trustees, Inc., for The Engineering Foundation, 29 W. 39th St., New York. Vol. I, $5.00; Vol. II, $4.00; Vol. III, $3.00. Special rates to members of the Founder Societies.

Printing of this second volume of the reports of the Committee on Arch Dam Investigation completes the publication of the record of the notable work done by that committee. Volume I was published as Part 3 of the *Proceedings* of the American Society of Civil Engineers, May, 1928. Subsequently, under date of June, 1931, the present volume was issued as a mimeographed manuscript in a limited number for filing in the more important engineering libraries. Volume III was issued in book form in May, 1933. It covered experimental work and tests on several dams and on celluloid models of the Stevenson Creek Dam, also a bibliography on arch and multiple-arch dams. Volume II, now available in printed form, covers the work done in testing small models of Stevenson Creek Dam and Gibson Dam, together with auxiliary tests of concrete specimens in connection with the tests of the models.

For Contractors

HELPS TO SUCCESSFUL CONTRACTING—By Harry O. Locher. A series of articles published originally in *Construction Methods.* Cloth; 5x8 in.; pp. 222. Published by McGraw-Hill Book Co., Inc., New York City. $2.00.

MEN, equipment and the application of common sense to construction problems are the main subjects of this book. Throughout, every point or contention made is illustrated by citing an actual incident drawn from the author's experience or contacts. And there's many a chuckle in the recitation of actual happenings on the job. They are amusing to read, but were undoubtedly far from funny at the time of happening. Much stress is laid on equipment, its selection, use and maintenance. The folly of using improper or obsolete equipment is strikingly shown, and the wisdom of standardizing and avoidance of "tailor-made" machines is also clearly shown.

The title of the book, therefore, is misleading—it smacks of the "job hint" type of material where an extra snatch block solves the sheetpile pulling problem, etc. In reality, the seventeen chapters are crammed full of good sound advice for the operation of a successful contracting business, from bidding to clean-up. There are no impractical, idealistic theories advanced. The author has his feet on solid ground throughout.

The book is a human document, and stresses from cover to cover the value of human relationships on the job. Time after time the importance of selecting a real superintendent to take charge is mentioned. Relations between the contractor and his superintendent, between superintendents and foremen and between the supervising personnel and the engineers on the job are played up to good advantage. Cooperation is shown to be the keynote of successful contracting operations. The chapter on accident prevention is a gem in its class. It makes the reader feel that accident prevention is a personal, humane problem, and not merely a set of rules forced upon the work by insurance inspectors.

The contracting world is indebted to the author for placing in cold type what it already knows, but what it should be reminded of constantly. Much of the grief in construction operations comes not from ignorance but from failure to use common, everyday knowledge and good old horse sense.

New Books and Revised Editions

[*Those desiring copies of the books listed below or mentioned elsewhere in this section should order them from the publishers or from their local booksellers.*]

CITY GOVERNMENT IN THE UNITED STATES—By Charles M. Kneier. Cloth; 6x9 in.; pp. 482. Published by Harper & Brothers, New York and London. $3.

THE CITY-MANAGER PROFESSION—By Clarence E. Ridley and Orin F. Nolting. Cloth; 5x8 in.; pp. 135; tables. Published by The University of Chicago Press. $2.

CIVIL ENGINEERING HANDBOOK—By Leonard Church Urquhart. Flexible; pp. 885; diagrams, tables and photographs. Published by McGraw-Hill Book Co. Inc., New York and London. $5.

COAST EROSION AND PROTECTION—By Ernest R. Matthews. Cloth; 6x9 in.; pp. 228; photographs and line drawings. Published by Charles Griffin & Co. Ltd., London, and J. B. Lippincott Co., Philadelphia. $6.

ENGINEERING SURVEYS—By Harry Rubey. Flexible; 5x8 in.; pp. 430; photographs, diagrams and tables. Published by The Macmillan Co., New York. $3.

ENGLISH FOR ENGINEERS—By S. A. Harbarger. Cloth; 5x8 in.; pp. 314. Published by The McGraw-Hill Book Co., New York and London. $2.

GEWAPEND-BETON EN IJZER IN DEN BRUGBOUW—By J. Emmen. Cloth; 10x13 in.; pp. 164; photographs and line drawings. Published by H. J. Paris, Amsterdam, Holland.

GROWTH AND MOVEMENT IN PORTLAND CEMENT CONCRETE—By C. G. Lynam. Cloth; 6x9 in.; pp. 139; diagrams. Published by Oxford University Press, 114 Fifth Ave., New York, $3.50.

HIGHWAY ENGINEERING—By John H. Bateman. Second Edition. Cloth; 6x9 in.; pp. 441; photographs and diagrams. Published by John Wiley & Sons, Inc., New York. $4.

IDENTIFICATION OF THE TIMBERS OF TEMPERATE NORTH AMERICA—By Samuel J. Record. Cloth; 6x9 in.; pp. 196; photographic illustrations and diagrams. Published by John Wiley & Sons, Inc., New York. (Chapman & Hall, London) $3 plus postage.

INTERNATIONAL ASSOCIATION FOR BRIDGE AND STRUCTURAL ENGINEERING, PUBLICATIONS—VOL. II—Paper; 7x10 in. pp. 495; photographs, diagrams and tables. Published by A. G. Gebr. Leemann & Co., Zurich, Switzerland. 34.80 Swiss francs . . . *The papers are printed in English, French or German, with summaries in all three languages.*

MECHANICS OF ENGINEERING—By Sherman Daniel Chambers. Cloth; 6x9 in.; pp. 275; diagrams. Published by The Macmillan Co., New York. $3.50.

ENGINEERING NEWS-RECORD

EDITOR—F. E. Schmitt. EDITORIAL STAFF—V. T. Boughton, W. G. Bowman, F. W. Herring, C. S. Hill, H. W. Richardson, J. I. Ballard, W. W. De Berard, N. A. Bowers.

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Ending Confusion

THE CONFUSION created by the overlapping of the Bacon-Davis Act and PWA minmium-wage regulations has been ended by a Presidential order temporarily suspending the prevailing-wage provisions of the former. Weak from the start because it failed to provide for determination of wages before signing of contract, thus leaving the contractor at the mercy of the Labor Department after start of work, the Bacon-Davis Act has long been a disturbing element in federal building construction. Organized labor interests endeavored to have union *scales,* not actual wages, proclaimed as the prevailing rates of pay, and in the settlement of many labor disputes this contention was upheld by government labor authorities. Whatever advantage the act may have held for labor was largely nullified by unscrupulous rebating of wages. Intended to eliminate this vicious practice, the act really encouraged it by setting up unreasonable wage scales, often much higher than anticipated by the contractor in bidding. Now that the major part of all federal construction is being financed by the PWA there is no longer any justification for the Bacon-Davis Act because labor is protected by PWA minimum-wage regulations. The temporary suspension of the Bacon-Davis Act should be made permanent.

Behind the Dust

DUST STORMS should not be allowed to obscure the serious engineering aspects of the calamitous drought in the north-central states. With precipitation records for a group of twelve states averaging less than one-half normal during the spring, as outlined on another page, every phase of water development and use will be faced with new problems. In the field of water supply there will be the inevitable struggle to maintain quantity and quality of municipal supplies during the coming peak-demand months of the summer in the face of unprecedented low flow in the streams of the area. Equally severe will be the aggravated problems of sewage disposal, with the further incidental effects on power production schedules and navigation. Aside from these immediate demands there is the more significant question that, every time new low-flow records are established, engineers must anticipate that these, in turn, may again be broken in the future. These new minima estimates should form a new datum for future studies of water development. Each time a new record of a natural phenomenon is established, either low flow or floods for streams, or high winds or earthquake, there must follow a re-basing of the correlated engineering thinking.

Research and Invention

THE RECORD OF RESEARCH and invention that runs through the account of the development of the asphalt revetment mat, published in this issue, is one of which all those concerned may well be proud. This includes engineers of the Second New Orleans Engineer District and of the Engineer Depot, engineers and specialists loaned to the district from other federal departments, the specialists of the Asphalt Institute and the manufacturers of construction equipment who participated in the development of the special equipment used in the fabricating plant. Outstanding in the research work was the discovery that loess, a non-alluvial material that is found in vast quantities capping the bluffs in part of the lower Mississippi River valley, is superior as a filler for asphalt paving to the materials now commonly used, and much less expensive. This discovery brought the cost of an asphalt mixture for revetment mats down to what was considered a sufficiently low figure to justify going ahead with the development of a plant to fabricate the mats. The plant itself is notable for the many ingenious elements that have been combined to make it possible to fabricate and launch the mat at a rate of 6,500 sq.ft. an hour. In most instances the equipment is an adaptation of standard equipment to meet special conditions.

Models as Design Aids

PROMINENT among the changes that have taken place during recent years in the broad field of structural and hydraulic design is the increasing use of models, as signalized by the eight-session conference on the subject which preceded the S.P.E.E. meeting at Cornell. The indeterminate nature of structures of reinforced concrete and more recently of welded structural steel has fostered wide emulation of the work pioneered by Beggs and others. And in the field of hydraulics the successful river work at Vicksburg and Iowa City and the dam studies at the Bureau of Reclamation and Worcester Polytechnic Institute have given a like fillip to model studies in this field. But in the success of the work so far done lies a distinct danger, for this success is the product of specialists who know models and their limitations and, most important, are well versed in the mathematical analysis which the model is designed to supplement. To the large majority of engineers, models are a new tool and as such may be used both incorrectly and too often. The first requirement to the use of models is an intimate knowledge of the laws of similitude. Equally important is a knowledge of the mathematical processes of indeterminate analysis, for models must be designed and are not just built. Finally, there is required a proficiency in constructing and operating models. It behooves engineers to master this new science, not only that the advance may be rapid but that it may be basically sound from its inception.

Rugged Individualism

CONSTRUCTION and engineering may in future undergo changes as profound as in the past, but there are technical questions that seem destined to remain active throughout all change. At least, should they temporarily become dormant it will take only a suggestion from some engineer that he has a new answer to revive any one of them from oblivion. Such questions are the calculation of size and spacing of stirrups in concrete beams, the figuring of vertical curves for highways, and the determination of Kutter's *n*. These and like technical points engender more "rugged individualism" among engineers than does almost any major subject. No matter how startlingly simple or logically sound an engi-

neer s proposed solution may be for one of these problems, he will gain hardly a single adherent; on the contrary he will be advised by sources far and wide of other solutions much more simple and logical than his own. And is he won over? We doubt it. Long observation convinces us that his own scheme thrives on opposition, and practical experience indicates that it makes little difference if each engineer has his own favorite solution. Even if it did, we see little that could be done about it. In fact nothing ought to be done, for during times such as those of the past few years, when activity in engineers' offices is at a standstill, the mental stimulation derived through devising a nomograph for stirrup spacing must be a blessing indeed.

PWA Labor Regulations

PRACTICAL considerations are ignored in the administration of the PWA labor regulations on construction work financed wholly or in part by the federal government. In theory the regulations are well-meaning—to give local residents preference in local jobs and to spread available work as far as possible by limiting working hours of the individual. In actual practice the desired result for the most part is being obtained, but only at an excessive cost in money, efficiency and accidents. The first of these affects the public, which pays for the work; the second affects the structure being built; while the third affects the workmen themselves. At the opening of a new year of PWA operations it is time to stop and consider whether practically the same result cannot be obtained with more normal construction-labor conditions.

The labor regulations require that all labor except that for certain key positions be drawn from local relief lists, and that the working hours of an individual be limited to eight per day and thirty per week. Contractors must take the labor sent to the job by federal employment office, at least for a trial period. As applied to common labor, this results in extra expense to the job and a definite accident hazard until the men, usually inexperienced and often physically unfit, can be properly trained. But it is with the skilled labor class that this regulation causes most trouble. The skilled construction worker is a specialist in his line. Whether he is bricklayer, truck driver or power-shovel runner, the unskilled worker is a hazard to life and property alike until he is proven capable. Especially is this true of equipment operators. To force a contractor to use green and untried operators even for a trial period is both an injustice and a hazard. Equipment is expensive and represents a large share of a contractor's capital investment. In a few brief moments an ignorant operator can ruin the finest piece of construction equipment.

Even disregarding this economic loss, the accident hazard of an unknown operator cannot be overlooked. A false move may mean a serious accident involving loss of life. On one PWA job a relief-list operator, claiming to be experienced, dropped a 75-ft. crane boom during his first few minutes on the job. Fortunately, none of a crew of laborers working around the crane was in the path of the falling boom. Concrete buckets have been dropped into forms on other jobs, trucks have been run into scaffolding and off fills, and many a more serious accident has been charged to an unskilled operator who claimed ample experience.

Another source of constant trouble is the strict and unreasonable interpretation of the overtime clause of the hours-of-work regulation. Prosecution of construction involves a battle with the forces of nature, always subject to the unexpected. Plant and equipment layouts are of a temporary nature by necessity, as are haulage schedules and deliveries of materials. These temporary arrangements are subject to disruption and resulting delay, as every construction man knows. At best, construction is a hazardous and uncertain operation from start to finish. Overtime, therefore, is often inevitable and should not be regarded as a crime. No construction work can be prosecuted to the best advantage of the job or the community if thirty minutes of unavoidable overtime is classed as a major breach of contract, as is frequently done by the federal labor inspector. Reason must be employed in interpreting federal regulations.

Immediate liberalization of the PWA labor regulations, at least in two respects, is important. First, let the contractors have greater freedom in the selection of foremen and skilled labor, especially where life and property are involved. Then adjust the working-time provisions to a practical basis with full recognition of the emergency and hazardous nature of construction, with discretionary allowances for necessary overtime. These changes would lower the cost of PWA work considerably, make for better construction and reduce the present accident hazards.

Evolution in Education

IF INDICATIONS at last week's meeting of the Society for the Promotion of Engineering Education may be taken at face value, engineering educators have chosen evolution as the vehicle of change for the college curriculum. This is not to imply that the choice lay between evolution and revolution, for revolutionary tendencies are not common to and seldom desirable in professional engineering circles. The choice was rather between evolution and a static or even reactionary plan. The evolutionary choice is significant because it connotes progress and an alertness to the modern needs of the student and the engineering profession. Evolution is inherent in President Wickenden's plea for liquidation of worn-out practices and the institution of less exacting schedules in what he terms a change from "discipline to discipleship" in the relationship of student and teacher. It lies at the core of the ideal laid down by Harvey N. Davis of Stevens Institute of Technology, in which it would never be the function of engineering schools to teach a technique or a trade but only to impart to the student a point of view compounded of a knowledge of the fundamentals of science and "an appreciation of the best of what is going on in the world." He would build psychology into the curriculum as economics has been built in since the time of Wellington's "Economics of Railway Location." Other speakers mentioned "cultural appreciation" and "self-salesmanship." All of this seems sensible, sound and reasonable. Such a plan faces the facts of modern living. It should turn out men more capable of becoming good engineers in the broadest sense of the term. And it should in no way disrupt the present courses or teaching methods which have stood the test of time. An evolutionary development should, in short, supplement present engineering school knowledge with that other knowledge which the past few years have indicated is necessary for effective living in a changing world.

CURRENT NEWS

Bacon-Davis Wage Act Suspended by President's Order

EFFECTIVE for all contracts entered into on and after June 16, 1934, the provisions of the Bacon-Davis prevailing wage act applying to federal building construction have been suspended by an executive proclamation by President Roosevelt dated June 5. The order was revealed at testimony before a Senate committee holding hearings on the "kick-back" racket on June 22. Concurrent operation of the Bacon-Davis Act and the wage provisions of NIRA and PWA were causing considerable confusion, and the suspension order was recommended by Secretary Perkins and Administrator Ickes. The Bacon-Davis Act, enacted March 3, 1931, required that prevailing wages be paid on all federal building work but failed to stipulate predetermination of wages prior to award of contract. This left contractors uncertain of ultimate wages to be paid. All efforts by the Associated General Contractors and other construction interests to have the act amended to include predetermination of wages were futile. The order apparently leaves work under direct appropriations of the treasury department, for which $65,000,000 was appropriated by the last Congress, without any wage provisions, as PWA regulations will not apply.

Plan to Charge Tunnel Toll Protested by Pittsburgh Group

Action on the application of the Allegheny county authorities (see *ENR* June 21, 1934, p. 818) for a $30,000,000 PWA loan and grant is held up by the protest of representatives of some of the Pittsburgh communities against the plan to charge tolls on the Liberty tunnels.

The toll plan is for the purpose of liquidating the cost of improvement of the traffic system at the south end of the tunnels and other traffic arteries used in connection with the Liberty Bridge and tunnels, for which part of the $30,000,000 loan and grant is sought. The protestants claim that the imposition of tolls for the use of the tunnels will penalize them by compelling them to pay more than their share of the cost of the county-wide series of public works projects for which the loan is sought.

Municipal Engineers Society Joins Administrative Group

The American Society of Municipal Engineers and the International Association of Public Works Officials have affiliated with Public Administration Service, a joint agency of national associations of public officials organized to improve administrative standards of government.

Large Refund by Water Company Ordered by State Commission

Refunds to water consumers aggregating about $3,000,000 has been ordered by the Pennsylvania Public Service Commission to be paid by the Scranton-Springbrook Water Service Co. The refunds are on payments for water service collected by the company since July 1, 1928. A controversy on rates has been under way since June of that year.

The refund results from the commission's decision that a 6 per cent return, which is in accordance with a recent resolution reducing the rate from 7 per cent, on a new valuation should give a gross revenue not in excess of $1,737,372 annually from July 1, 1928, to June 30, 1933, and $1,610,268 annually from July 1, 1933, to the present time.

The company was ordered to file new rates for those periods that would yield the stated amount of gross revenues.

Four years have been allowed the company to make the refunds. The order becomes effective immediately unless there is further court intervention.

The company supplies water to a number of communities in the Scranton region.

First Contracts for Sewer Work Awarded on Twin City Project

By a unanimous vote the trustees of the Minneapolis-St. Paul Sanitary District, on June 25 provisionally awarded the first two contracts for the sewerage project of the district. The Feyen Construction Co., St. Paul received the contract for the interceptor tunnel at John Street, St. Paul, for $398,733, and the Middlewest Roads Co., Flint, Mich., received the contract for the Dayton Bluff tunnel for $449,476, both subject to approval by the Public Works Administration.

The trustees balked at the proposal of the new consulting board that its members receive $100 per day, including William N. Carey, State PWA engineer, plus traveling expenses and per diem of $6.00 in lieu of lodging and subsistence; this rate to apply for 120 days and thereafter $50 per day with no limit.

The consulting board refused to give a contract to perform the work for an estimated amount and refused to give a guarantee for satisfactory operation of the treatment plant. The trustees, therefore, postponed action and adjourned until Wednesday noon June 27.

Engineering Educators Seek to Broaden Student Training

THROUGHOUT the sessions of the 42d annual meeting of the Society for the Promotion of Engineering Education, held at Cornell University, Ithaca, N. Y., June 19-23, the subject of developing broader interests on the part of engineering students recurred again and again. The civil engineering session of the general meeting was devoted to the economics of the several fields. Gordon M. Fair (Harvard) gave a paper entitled "The Liberal Pursuit of Engineering Education"; R. E. Doherty (Yale) described how one-third of the electrical engineering course is devoted to social as contrasted to scientific studies; Harvey N. Davis (Stevens Institute of Technology) urged the necessity of building psychology into the curriculum, and W. E. Wickenden (Case School) and president of the S.P.E.E., voiced a plea for a basic change in university objectives, discarding "the present discipline (enforced alike on engineering student and teacher) for a discipleship" between teacher and student. These speakers and others recognized that the narrowing influences of many existing curriculums must be superseded, and attempted to outline possible ways to achieve the desired result without diluting the fundamental engineering knowledge that is absolutely essential. A registration of 1084 made the meeting the largest yet held. The conferences in various special fields that preceded the general session were well attended, in particular those devoted to hydraulic and structural models which attracted several hundred teachers and others. The conferences are reviewed in detail elsewhere in this issue.

The general sessions which began on Thursday were distinguished by addresses from the speakers mentioned above, and in addition included a symposium on "Marketing the Graduate's Services," and another on "Professional Recognition and Educational Standards."

C. C. Williams, dean of engineering, University of Iowa, was elected president of the Society for the coming year. The Lamme medal given annually for outstanding service to the cause of engineering education was awarded to Edward R. Maurer, professor of mechanics, University of Wisconsin. Next year's meeting will be held at Atlanta, Georgia.

Civil engineering division

Previously civil engineering matters in the S.P.E.E. have been handled by a committee. At Ithaca it was voted to establish a civil engineering division with a new form of administration, having a president, secretary and executive board. Frank Kerekes (Ames) was elected president and Fred L. Plummer (Case School) secretary. The executive board is composed of Thomas R. Agg (Ames) and Gorden M. Fair (Harvard), one year; Professors Kerekes and Plummer, two years; and L. E. Grinter (Texas A.&M.) and K. C. Reynolds (M.I.T.), three years. There are some 400 members of the S.P.E.E. eligible to join the civil engineering division.

As stated, the meeting of the civil en-

gineering division centered on methods of teaching economics in connection with the various technical courses. B. R. Van Leer (Florida) on hydraulics, Ivan C. Crawford (Idaho) on municipal engineering, T. R. Agg (Ames) on highways, William G. Grove (Robinson & Steinman, consulting engineers, New York) on steel bridges, and Fred L. Plummer (Case School) on reinforced concrete were the principal speakers. The apparent ease with which economic principles and considerations can be introduced into such courses was brought out, in highways by emphasizing financial methods and economical design and construction, in hydraulics by stressing the commercial aspects of turbines, pumps, etc., and in steel bridges by giving consideration to the answers to the questions of where, when and how to build. Professor Plummer suggested that it might be better to teach a student when to use a flat slab floor than to instruct him in its detail design, in other words, to reverse the emphasis as it is now applied. Case School has instituted a half-time business option course, but discussion indicated that such a course was deemed unnecessary by some of those present.

Trends in teaching

At the final session of the models conference, Clyde T. Morris (Ohio State) and Robinson Abbott (Tufts College) read papers on the trends in teaching structures and hydraulics. Laboratory demonstration is a modern essential to the teaching of mechanics, in Professor Morris' opinion. Students are being advised of the limitations which often must be placed on assumptions used in analytical design; formerly these assumptions have been given the reputation of unassailable facts. There is an increasing use being made of models as an adjunct to design teaching and there is an increase in research on the part of teachers tending to improve their usefulness and abilities.

Professor Abbott in discussing hydraulics emphasized laboratory work and the increasing use of models. He urged more colleges to build and equip large laboratories, pointing out that one of 4 sec.-ft. could be put in operation for $2,000. In teaching the basic principles of laboratory practice two factors must be stressed and made perfectly plain—the laws of similitude and Reynolds Number. Too many students have no familiarity whatever with these factors.

In the symposium on marketing the graduate's services, W. A. Shoudy (Columbia) told of a new course planned to develop better job-getting qualities in the engineering student. S. S. Board (Yale) outlined the course as he and Professor Shoudy have planned it. Discussion indicated a widespread sympathetic attitude toward such a course, whose central thought was "selling yourself and your abilities." A significant contribution was made to the discussion by several present who pointed out the possibilities in the small engineering business located in the small town as a field for technical graduates.

Several instructive exhibits were held in conjunction with the meeting. These included hydraulic and structural models, exhibits of drafting work and an unusual exhibit of old instruments, old drawings and old prints.

First Contracts Awarded for All-American Canal Excavation

Contracts for the first seven schedules of the All-American Canal in Southern California were awarded on June 23 by the Bureau of Reclamation. Six of the schedules, involving 30 miles of main canal excavation, were for $4,859,587, let to a combination of Callahan, Shirley and Gunther, St. Louis, which has the Madden Dam in Panama. Included in these sections are 39,349,000 cu.yd. of common excavation and 28,000 cu.yd. of rock removal. Schedule 7, comprising 10,000 cu.yd. of common and 500,000 cu.yd. of rock excavation within the limits of Schedule 4, was let to the Griffith Co., Los Angeles, for $226,800. This bidding supplemented the call of Dec. 7, 1933, when bids for 21,000 ft. of main canal were rejected. The sections included in the present letting start at Laguna Dam, 5 miles below the proposed Imperial Dam, the future diversion point on the Colorado River, and run generally westward for 30 miles, stopping just short of the proposed junction of the main canal and the Coachella branch. The main canal will be 80 miles long, and the Coachella branch will extend for 130 miles. Siphons, concrete lining and compacted lining, where required, are not included in the present contracts. Complete unit prices, a map and typical sections are shown on page 856 of this issue.

PWA Threatens to Rescind Allotments on Delayed Projects

To clean the slate for the new public works program, 23 per cent of all allotments made to date for non-federal projects will be rescinded unless immediate steps are taken to commence construction. Recipients of 563 allotments totaling $158,558,517 have been so notified by PWA. Administrator Ickes announced June 21 that they will be given about ten days in which to take action to save their allotments. Recission of 97 allotments totaling $8,217,042 was announced the same day.

Bond contracts and grant agreements have been executed for all the projects slated for recission but none of them has been advertised for contract. In some instances, local regulations or controversies have blocked construction but so far as PWA is concerned, said Ickes, the projects are ready to go and have been for weeks.

The objective of Ickes' clean-up campaign is obviously to speed up the public works program. The money now lying idle will augment considerably the maximum of $500,000,000 ear-marked for public works in the new budget and the $250,000,000 which PWA may recoup by selling to the Reconstruction Finance Corporation bonds purchased as security on municipal projects.

NEW YORK CENTRAL ELEVATED LINE PUT INTO SERVICE

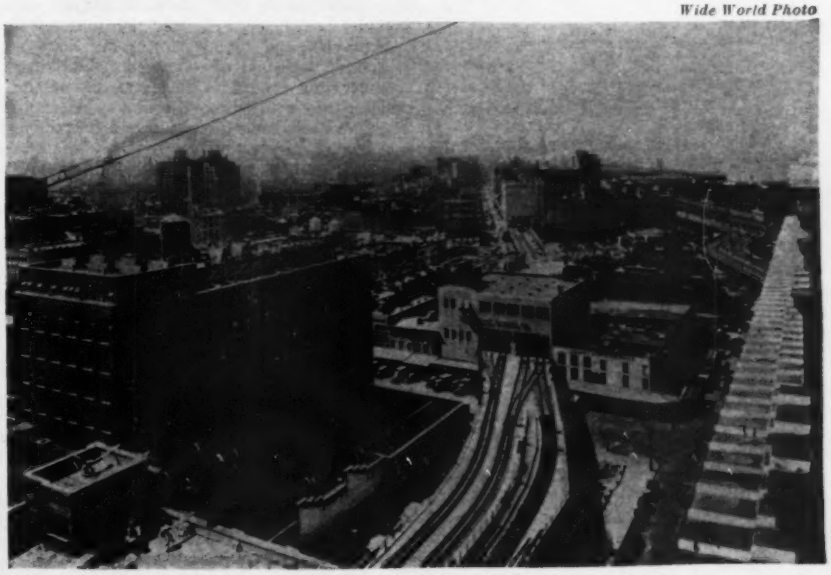
The elevated section of the New York Central Railroad's West Side Improvement south of the 30th Street Yard, New York, including the new terminal north of Canal St., was formally put into service on June 28. With the putting into service of this new elevated line the surface tracks in 11th Ave. from the 30th St. yard south to the St. John Park terminal below Canal St., a distance of about one mile, will be taken out of service. South of the 30th St. yard the entire line is elevated, largely along a private right of way.

The accompanying photograph is taken looking south from about 15th St. In the foreground is the 14th St. crossing where the tracks pass through a warehouse recently built by the Cudahy Packing Co. Below Little West 12th St. the railway runs on a private right of way parallel to Washington St., the elevated structure being carried through some of the existing buildings, notably the Bell Telephone Laboratories (*ENR* Nov. 30, 1933, p. 641). Some buildings have private sidings.

At the right in the picture is shown the elevated highway on the Marginal Way along the Hudson River waterfront.

North of the 30th St. yard the tracks will be depressed below street level as far north as the 60th St. yards. Work on that section, other than the acquisition of right-of-way and demolition of buildings, has just been begun.

Wide World Photo



United Engineering Trustees Elect New Secretary

The Board of Trustees of United Engineering Trustees, Inc., at its meeting on May 25 elected John Arms to be secretary to succeed Alfred D. Flinn, whose resignation was accepted at the same meeting. United Engineering Trustees, Inc., administers the Engineering Societies Building and the Engineering Societies Library in New York City, and the endowment funds of the four founder engineering societies. Mr. Arms has been general manager of the corporation since December, 1933, and will continue to hold that position in addition to the secretaryship. He is an industrial engineer, a member of the firm of Arms & Madeheim.

Hayden-Cartwright Fund For Highways Apportioned

The $200,000,000 authorized by the Hayden-Cartwright act for highway construction on June 18 was apportioned among the 48 states, Hawaii and the District of Columbia. Following the requirements of the law, seven-eighths of the total authorization is apportioned on the basis provided by the federal highway act which prescribes three factors of equal weight, based upon the area, population, and rural post road mileage. The remaining one-eighth is apportioned according to population.

The law requires that in the absence of satisfactory reasons to the contrary, not less than 25 per cent of the apportionment to any state must be applied to secondary or feeder roads, including farm-to-market roads, rural free delivery roads, and public school bus roads. The amounts apportioned to each state, Hawaii, and the District of Columbia, follows:

State	Apportionment
Alabama	$4,259,842
Arizona	2,641,935
Arkansas	3,428,049
California	7,932,206
Colorado	3,486,006
Connecticut	1,454,868
Delaware	923,395
Florida	2,661,343
Georgia	5,113,491
Idaho	2,277,486
Illinois	8,921,401
Indiana	5,088,963
Iowa	5,118,361
Kansas	5,117,675
Kentucky	3,818,311
Louisiana	2,963,932
Maine	1,711,586
Maryland	1,810,058
Massachusetts	3,350,474
Michigan	6,452,568
Minnesota	5,425,551
Mississippi	3,540,227
Missouri	6,173,740
Montana	3,769,734
Nebraska	3,964,364
Nevada	2,302,356
New Hampshire	969,462
New Jersey	3,220,879
New Mexico	2,941,700
New York	11,327,921
North Carolina	4,840,941
North Dakota	2,938,967
Ohio	7,865,012
Oklahoma	4,685,180
Oregon	3,097,814
Pennsylvania	9,590,788
Rhode Island	1,014,572
South Carolina	2,770,954
South Dakota	3,047,643
Tennessee	4,302,991
Texas	12,291,253
Utah	2,132,691
Vermont	948,007
Virginia	3,765,387
Washington	3,106,412
West Virginia	2,280,335
Wisconsin	4,941,837
Wyoming	2,287,712
Dist. of Columbia	973,842
Hawaii	949,778
Totals	$200,000,000

Department of the Interior To Have New Building

Construction of a new building to house the Interior Department in Washington will be undertaken immediately and pushed rapidly to relieve present congestion in government office space. The site selected is located to the south of the present building, with a small park intervening, on two blocks bounded by C and E Sts., and 18th and 19th Sts. N. W.

The cost was estimated by Administrator Ickes several weeks ago at $10,000,000, but the actual figure has not been established. The plans are now being drafted. Part of the site is now owned by the government. Private owners will be given an opportunity to sell at fair reasonable market value but if unwilling to do so, condemnation proceedings will be filed. The building will be air-conditioned.

Port Authority Property Not Subject to Taxation

The property of the New York Port Authority was held to be exempt from taxation by the state supreme court on June 20 when it dismissed a suit to restrain New York City from accepting a $60,064 annual tax for the Inland Terminal. Action was brought by several dock and warehouse concerns contending that the Port Authority's terminal should pay $400,000 taxes and that the $60,064 agreement enabled the terminal to compete unfairly with private enterprises.

In dismissing the suit, the court found that since the Inland Terminal property is tax exempt, the tax the Port Authority has agreed to pay is a gift to the city. The sum represents the tax paid on the property before it was acquired by the Port Authority.

Additional Code Explanations Issued Covering Controversial Questions

THE Construction Code Authority has issued explanations 21 to 27, inclusive, in regard to various questions raised as to the meaning of the code.

Explanation 21—Owner shopping for bids. Even though a reduction in price may be made through bid shopping on the part of the awarding authority, the bidder is not permitted to accept such price, and becomes party to a violation of the code if the award is made at less than the bidder's original bid price.

Explanation 22—Maintenance work in manufacturing plants. In regard to maintenance work in industrial plants, each divisional chapter must be examined to determine whether maintenance work is covered. So far as Chapter I is concerned the definition includes only the modification of building structures or of fixed structures and other fixed improvements. Coverage of the several divisional chapters varies with respect to maintenance work. The general contractors' chapter covers not only modification of structures but also repairs thereto. The painters' chapter excludes painting performed by permanent employees, and not for hire, in buildings or structures owned or occupied by building owners or tenants. The chapter of the electrical contracting division specifically includes repairing, servicing or maintaining electrical wiring and equipment. The elevator manufacturing chapter definitely covers repair work; and the cement-gun contracting chapter covers all work performed by this method. The definitions in certain other chapters of the code cover the contracting for particular work described, and where maintenance and repair is specifically included, it would be covered by the code when performed by a member of the division.

Explanation 23—Construction work performed by industrial firms. All construction work performed by industrial companies must be performed in accordance with the provisions of the code, including Chapter I, and provisions of the various divisional chapters. When such construction work is performed by day labor method under the direct supervision of the company, the individual company becomes a member of the industry. When the work is performed by wholly owned construction subsidiary, working exclusively for the company, this subsidiary becomes a member of the industry and is subject to the code.

Explanation 24—Definition of subcontractor. Question has been raised regarding the status of vendors who supply materials specifically required for a particular project, being designed or fabricated under specifications for the project in regard to classification as subcontractor and therefore subject to the bidding practices mentioned in the code. Section 1 (a) of Article VII, Chapter I, defines competitive bidding as the submission of comparable proposals by two or more invited persons to execute a specific program of work, furnish a definite service or supply materials specifically required for a particular project at a stipulated price. Obviously, the term "subcontractor" as used in Section 7, Chapter I, includes those furnishing materials only when competitive bids are asked for according to the code, and such bids must be submitted by the subcontractor not less than 24 hours prior to the time set for receipt of the bid of the contractor by the awarding authority. Where competitive bidding is not used, the code does not specify the requirements as to when prices shall be submitted to the contractor. Explanation 24 should be considered in conjunction with Explanation 9, issued May 31 (*ENR* June 7, 1934, p. 753).

Explanation 25—Application of Chapter I. Chapter I applies to all members of the industry, irrespective of divisional affiliations. Chapter I was drafted as a complete framework, covering all functions of the industry included in its definition, and additional chapters only supplement this framework by providing special regulations for different branches of the industry. It is a complete code document, covering hours, wages, conditions of employment, code administration and competitive bidding practices, all of which are binding upon the members of a division of the industry who are under an additional chapter (except as provisions of the additional chapter conflict therewith) and provide the

only code regulations for other members of the industry whose specific functions have not been defined in an additional chapter approved by the President.

Explanation 26—Filing of estimates by general contractors. Special contracting groups have raised the question as to whether a general contractor should file copies of his estimate with the bid depositories either when he does not ask for bids from subcontractors but intends to perform the work himself, or when he does ask for bids from subcontractors but puts in his own figure when making up the bid to the awarding authority. In the first instance, competitive bidding is not involved, and hence the code regulations regarding bid depositories would be inoperative. In the second instance, although competitive bidding is entered into, the purpose of bid depository systems is to provide a method of checking the award, if made from bids submitted, against the bidder's original bid price, as a protection principally to all bidders. In this transaction, the general contractor occupies the position of an awarding authority if he obtains the job, and he cannot occupy the dual position of awarding authority and bidder. Accordingly, he would not be required to file a copy of his estimate of the work in question as a duplicate bid.

Explanation 27—Divisional inter-relations. There has been extended discussion as to the proper administrative procedure, including the handling of complaints as to violations of the provisions of divisional chapters when a member of the industry usually operating in one division performs work covered by another divisional chapter. The answer is based upon the provisions of the code which follow the principle of divisional autonomy. Administration of each chapter of the code is expressly delegated to the divisional code authority established under such additional chapter. Under the functional definitions of Chapter I, a member of the industry is defined as one engaged in any phase or undertaking to perform any of the functions of the industry; while member of the division is defined as any member of the industry engaged in one of the divisions of the industry, that is, undertaking to perform any functions of a division of the industry as defined in the provisions of the chapter applicable especially to such division. Accordingly, such member of the industry would be subject to the code administration of the divisional code authority established thereunder, including payment of approved assessment thereunder for code administrative expense, regardless of whether such member of the industry performs all of his work or services under that particular chapter, or only occasionally operates thereunder. This explanation does not conflict with the Administrator's order of April 14 which provides that a firm is required to pay an assessment for code administration only to the Code Authority governing its principal line of business, because the Construction Code is, in effect, only one code, and subdividing of assessments for administrative expense is a matter of internal organization. However, it implies that a general contractor will be subject to the approved assessments for work performed by his own forces under various other divisional chapters and places the same assessment on such work whether performed by his own workmen or through subcontractors.

FIRST TOWER ON SAN FRANCISCO-OAKLAND BRIDGE NEARS COMPLETION

On June 15, the west tower of the San Francisco-Oakland Bridge was topped out, and riveting is nearing completion. Erected by unique and ingenious application of hammerhead-crane equipment, this 440-ft. tower located just inside the San Francisco pierhead line will support one end of one of the 2,300-ft. suspension spans of the West Bay Crossing.

Hammerhead cranes, or T-derricks as they are sometimes called, have not previously been used on suspension-bridge erection. In this instance each crane consists of a vertical post 108 ft. long and a 53-ft. horizontal girder along which the hoisting sheaves are moved in and out on a carriage. The lower 40 ft. of the post is always inside the tower leg, which assures stability without the use of guys. Since each erection lift is 50 ft., the crane posts are practically incased before they are jumped to the next level.

The horizontal arms have 360-deg. rotation, although no more than 180 deg. has been necessary to serve erection requirements. Loads of as much as 80 tons have been lifted, using counterweights on the back end of the arm; for loads up to 50 or 60 tons no counterweighting is necessary. Hoisting motors and drums are located at the base of the tower and the lines run up inside each leg.

Erection of this tower, which contains 5,100 tons of steel, was begun on March 7. The tower legs have a maximum section at the base of 17x35 ft. The bridge will be a double-deck structure, and the location of the two roadways, 26 ft. apart, is indicated by the open spaces, where cross-bracing is omitted. Contract for the erection work is held by the Columbia Steel Co., a subsidiary of the U. S. Steel Corp.

Correction Note—

In our issue of June 14, page 787, the erection of the Cedar Street Bridge in Peoria, Ill., was incorrectly credited to the McClintic-Marshall Co. The contract for the superstructure of this bridge was awarded to the Kelly-Atkinson Construction Co., Chicago, Ill. (now Northern Bridge Co.). Fabrication of the steel was sublet to the McClintic-Marshall Co.

Public Buildings Selected For Deficiency Act Construction

Secretary of the Treasury Henry Morgenthau, Jr., and Postmaster General James A. Farley on June 25 announced the selection and approval of 302 public building projects to be paid for out of the $65,000,000 emergency construction fund authorized under the Emergency Appropriation Act. This act was signed by the President, June 20, and is effective for the fiscal year beginning July 1, 1934.

In addition, they made public a list of 324 other public building projects for which funds are already available from the PWA and on which work will be expedited. The two lists of projects will represent a combined expenditure of more than $110,000,000 scattered throughout all the States of the Union and territories.

The acquisition of the necessary land and the preparation of plans and specifications will be taken in hand immediately with a view toward getting the contracts on the market and awarded within the shortest practicable time.

Preference is being given to those projects for which the Government has previously acquired the necessary real estate for building purposes, so that immediate start may be made in the preparation of plans and specifications. In all other cases the real estate will be acquired as rapidly as possible.

Of the 302 projects, there are 191 small communities selected which do not have any federal building at the present time and where the average postal receipts last year amounted to approximately $29,500 per annum.

Federal Public Works Program Before Canadian Parliament

A federal public works program involving the expenditure of about $40,000,000 was presented to the Canadian House of Commons on June 19 by Prime Minister R. B. Bennett. Forecast by the Prime Minister last fall, the project has been put forward as a means of accelerating recovery, increasing employment and reducing relief expenditures.

The measure authorizing these expenditures will be known as the "Public Works Construction Act of 1934." It provides that the payments will be made out of consolidated revenues.

Generally the apportionment of the fund has been made among the different provinces according to need: Ontario, $10,000,000; Quebec, $9,000,000; New Brunswick, $2,900,000; Nova Scotia, $2,780,000; Manitoba, $2,300,000; British Columbia, $2,000,000; Alberta, $1,700,000; Saskatchewan, $675,000, and Prince Edward Island, $100,000. In addition there is an amount for public buildings, aids to navigation, harbors and rivers, Indian affairs, and Department of Interior, totalling about $7,800,000.

Items in excess of $1,000,000 include provision for a new postal terminal in Montreal to cost $1,800,000 and a new public building in that city to cost $2,000,000; barracks for the permanent force in Calgary, $1,200,000; public buildings in Hamilton, $1,750,000; public building in London, $1,500,000; building for the Royal Canadian Mounted Police in Ottawa, $1,-

200,000; harbor work at St. Johns, $2,000,000; public building in Vancouver, $1,000,000, and public building in Winnipeg, $1,500,000. An item of $2,500,000 is provided for harbors and rivers generally.

Obituary

FREDERICK B. SCHMITT, contractor of St. Louis, Mo., died at his home in a suburb of that city on June 17 from the effects of a heat stroke. He was 48 years old.

PATRICK DANIEL KELLY, a former railroad contractor, died in Coeur d'Alene, Idaho, on June 15, at the age of 65. Mr. Kelly, in partnership with his brother, built several tunnels for the Milwaukee railway between Spokane and Butte, Mont.

JARED S. BOGARDUS, civil engineer, of New York City, died of heart failure at his home on June 20 at the age of 51. Mr. Bogardus had been associated with the building of the Catskill Aqueduct. Later he was with the Guggenheim mining interests in South America. More recently he was in charge of subway contracts for Paul J. Moranti, Inc., in New York City.

FREDERICK S. ROLANDI, construction engineer, of San Francisco, Calif., following a long illness died at his home in that city on June 17. Born in Italy in 1878, Mr. Rolandi graduated from the engineering school of Turin University in 1901 and thereafter worked on a number of construction projects in South America, South Africa and China. He went to San Francisco in 1907.

GEORGE ALFRED DAMON, formerly dean of engineering at the California Institute of Technology, died of cerebral congestion on June 23. Mr. Damon graduated from the University of Michigan in 1895 and thereafter spent 16 years in association with Bion J. Arnold of Chicago, in charge of design and construction of railroad shops, electric railways and hydroelectric plants. He was 63 years old at the time of his death.

HIRAM NEWTON SAVAGE, chief water engineer of San Diego, Calif., died of heart disease in that city on June 24. He was 72 years old. Mr. Savage became an engineer in the United States Reclamation Service in 1904. While in that service he had charge of the investigation, design, construction and operation of 12 irrigation projects, including the Shoshone dam and the Corbet tunnel. He went to San Diego in 1916 to direct the rebuilding of the lower Otay dam. Since 1928 he had been chief water engineer.

CONSTRUCTION STATISTICS OF THE WEEK

ALL MAJOR classes of engineering awards contribute to this week's higher total, $32,055,000. Federal awards are up to $7,723,000, state and municipal to $17,174,000 and private to $7,158,000. These totale are ahead of the previous four week's average and substantially ahead of the average week in June, 1933.

Classes of work in which major increases are recorded include waterworks, with a total of $3,746,000; commercial buildings, $5,348,000; earthwork, irrigation and drainage, $5,942,000. Highways, at $8,748,000, are about 20 per cent above the figure of a week ago.

The larger contracts this week include: chemistry building at Wellesley College, Mass., $1,600,000; library at Temple University, Philadelphia, $550,000; art center, Colorado Springs, Colo., $500,000; two sections of Sky Line Drive, Virginia, let by Bureau of Public Roads, $791,000; highway lettings by Cook County, Ill., $1,117,000, and by New York State, $1,029,000; the San Francisco Bay Crossing of pipe line for Hetch Hetchy project, Calif., $2,371,000; equipment for New York City Water Tunnel No. 2, $750,000; first contract on Columbus sewage disposal plant, Ohio, $868,000; two contracts, All American Canal, Yuma, Ariz., $5,087,000; and 21 miles of railway for Meridian and Bigbee River Railway in Mississippi and Alabama, $750,000.

Bond sales for the week were numerous but in general small. They totalled $3,741,000. Two new private capital issues, one a distillery and the other railway construction funding bonds, totalled $1,314,000. Offsetting these, PWA net rescissions and reductions aggregated $9,041,000, leaving a net loss in new capital for the week of $3,986,000.

CONTRACTS
(Thousands of Dollars)

	Weekly Average Week June 1933	Prev. 4 Weeks	June 28 1934
Federal Government	$ 562	$4,427	$7,723
State and municipal	9,402	16,651	17,174
Total public	$9,964	$21,078	$24,897
Total private	10,871	5,544	7,158
Week's total	$20,836	$26,622	$32,055
Cumulative to date: 1933	$445,608	1934	$630,974

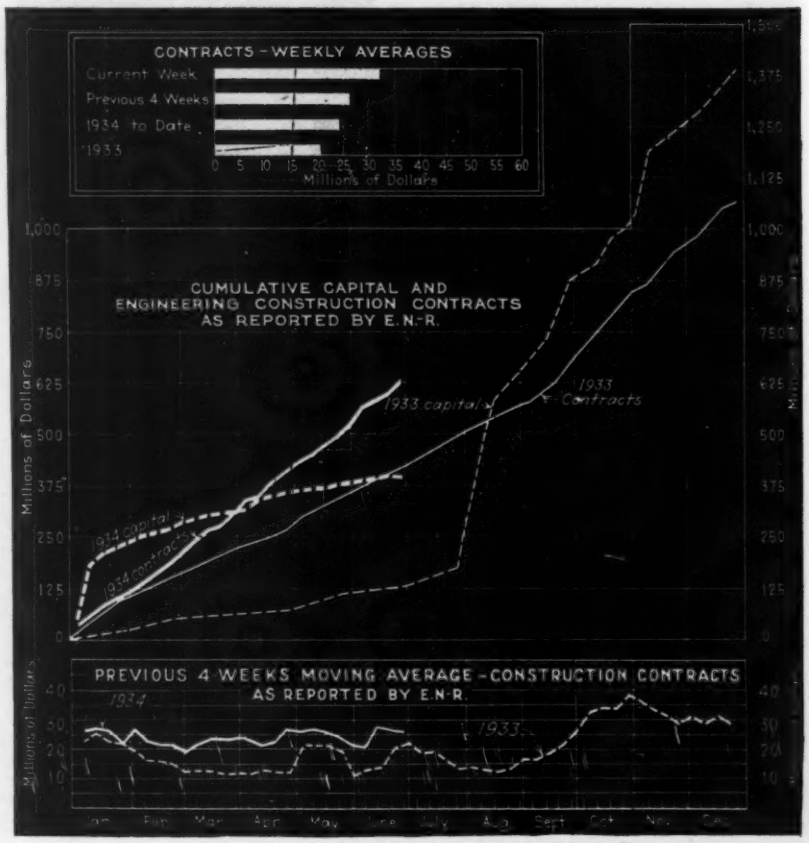
NEW PRODUCTIVE CAPITAL
(Thousands of Dollars)

1934	Week June 28	Cumulative
State and municipal	$3,741	$148,525
PWA allotments, S&M	— 9,041	173,663
RFC loans, S&M	....	9,413
Corporate issues	1,314	16,511
PWA allotments, private	....	50,448
Total, Non Federal	— $3,986	$398,550
PWA allotments Federal Constr.	....	49,568
Total new capital	—$3,986	$448,118
Cumulative to date: 1933	$132,457	1934	$398,550

NOTE: These figures include private bonds, and stocks sold for productive purposes; state and municipal bonds for construction; PWA loans and grants to states and municipalities, including the special highway funds; PWA private loans, and allotments for Federal construction.

INDEX NUMBER

E.N.-R.- Cost	1913 = 100	1926 = 100	E.N.-R.- Volume	1913 = 100	1926 = 100
June, 1934	**199.61**	**95.95**	**May, 1934**	**101**	**44**
May, 1934	199.61	95.95	April, 1934	109	48
June, 1933	163.41	79.02	May, 1933	103	45
1933 (Av.)	170.18	81.80	1933 (Av.)	102	45
1932 (Av.)	156.97	75.45	1932 (Av.)	127	56
1931 (Av.)	181.35	87.17	1931 (Av.)	220	96.5


CONTRACTS - WEEKLY AVERAGES
Current Week
Previous 4 Weeks
1934 to Date
1933
0 5 10 15 20 25 30 35 40 45 50 55 60
Millions of Dollars
CUMULATIVE CAPITAL AND ENGINEERING CONSTRUCTION CONTRACTS AS REPORTED BY E.N.-R.
Millions of Dollars
1933 capital
1933 Contracts
1934 capital
1934 contracts
PREVIOUS 4 WEEKS MOVING AVERAGE - CONSTRUCTION CONTRACTS AS REPORTED BY E.N.-R.
1934
1933
Jan Feb Mar Apr May June July Aug Sept Oct Nov Dec

Current Construction Unit Prices

Land Sections, Hetch Hetchy Pipeline

BIDS WERE received June 12 by the San Francisco Public Utilities Commission for the construction of 20 miles of land sections of the Bay Pipeline Crossing No. 2 in connection with the Hetch Hetchy water supply project. The work was divided into three sections. Alternate bids were asked for Section A, 59,700 ft. long: Prop. 1—26,600 ft. of 66-in. welded steel pipe, ⅜-in. plate, 33,100 ft. of 66-in. welded steel pipe, 7/16-in. plate; Prop. 2—59,700 ft. of 62-in. steel cylinder reinforced concrete pipe. Section B, 23,170 ft. long, involves 19,300 ft. of the 66-in. welded steel pipe and 3,870 ft. of 76-in. welded steel pipe. Section C, 24,890 ft. long, will be built with the 62-in. steel reinforced concrete pipe. Contractors were permitted to bid on any or all sections or any combination of sections. Five firms submitted 11 bids. The lowest combination was that of a combined bid on Section A, Prop. 1, and Section B, and a single bid on Section C. Contract was awarded on this basis to Western Steel & Pipe Co., San Francisco, and American Concrete & Steel Pipe Co., Oakland, for a total of $2,371,227.

The subaqueous section of the Bay Crossing No. 2 will consist of three 42-in. cast iron pipelines. Bids for this work as yet have not been called. N. A. Eckart is chief engineer of the water department, in charge of the work. Following are total summaries of all bids submitted and unit prices of the low bidders.

Mississippi River Levees

LEVEE WORK totaling 2,970,000 cu.yd. in the Lower Tensas Levee District was placed under contract June 6 by the U. S. Army, Corps of Engineers, Lt.-Col. J. N. Hodges, district engineer. The work involves the building of six sections of levee at Vidalia Point, La., varying in size from 380,000 cu.yd. to 550,000 cu.yd. Four of the sections involve both new work and riverside enlargement of existing levees, one section is all new work and one is all enlargement. Bids were taken on the basis of individual

SUMMARY OF TOTAL BIDS SUBMITTED FOR HETCH HETCHY PIPELINE

(Lowest combination shown in boldface type)

A—Western Pipe & Steel Co., San Francisco:	
Section A, Prop 1	$1,224,062
Section B	534,521
Section A, Prop. 1 and Section B	**1,722,298**
B—American Concrete & Steel Pipe Co., Oakland:	
Section C	**638,929**
Section A, Prop. 1 and Sections B and C	2,430,037
Section A, Prop. 2, and Sections B and C	2,559,728
C—Consolidated Steel Corp., Los Angeles:	
Section A, Prop. 1	1,247,733
Section B	542,052
Section A, Prop. 1, and Section B	1,760,590
D—United Concrete Pipe Corp., Los Angeles:	
Section C	658,830
E—Frazier-Davis Co. and G. L. Tarlton, St. Louis:	
Section A, Prop. 1, and Sections B and C	2,777,278

COMPLETE UNIT PRICES OF LOW BIDDERS, HETCH HETCHY PIPELINE BAY CROSSING NO. 2

	Item and Description	Quantities—Section A Prop. 1	Quantities—Section A Prop. 2	Quantities Sec. B	Quantities Sec. C	Unit Prices of Low Bidders—Lowest Comb.—Sec. A Prop. 1 Bidder A	Sec. B Bidder A	Comb. Sec. A (Prop. 1) & Sec. B Bidder A	Sec. C Bidder B	Comb. All Secs. (Prop. 1A) Bidder B	Comb. All Secs. (Prop. 2A) Bidder B
1	66-in welded steel pipe, ⅜-in. pl., lin. ft	26,600	1,880	.....	170	$15.25	$17.60	$14.95	$15.00	$14.80	$15.00
2	" " " " 7/16-in. pl., lin. ft	33,100	150	19,300	340	16.55	23.26	16.63	16.50	17.80	18.00
3	76-in. welded steel pipe, ⅜-in. pl., lin. ft	.....	.....	3,870	.....	.....	.....	22.96	.....	24.50	24.50
4	Steel pipe specials, lb	39,500	39,500	147,000	6,800	.136	.136	.136	.13	.12	.12
5	Felt wrapping on steel pipe, sq. ft	945,000	.....	.....	.....	.03	.....	.03	.....	.04	.....
6a	½-in. mortar covering on steel pipe, sq. ft	135,000	.....	.....	.....	.23	.....	.23	.....	.12	.....
6b	2-in. reinf. conc. covering on steel pipe, sq. ft	25,000	.....	.....	.....	.36	.....	.36	.....	.20	.....
7	Expansion joints for 76-in. pipe, each	.....	.....	18	.....	.....	810.00	803.00	.....	862.40	862.40
8	" " " 66-in. " "	3	3	2	1	760.00	760.00	752.00	650.00	640.00	640.00
9	Manholes for 150-lb. pressure, each	20	20	.....	5	146.30	.....	146.30	125.00	115.00	115.00
10	" " 250-lb " "	30	30	22	18	183.00	190.00	181.10	160.00	149.00	149.00
11	Cast steel saddle nozzles, lb	4,800	3,900	3,400	2,400	.35	.36	.34	.30	.27	.27
12	" " companion flanges, lb	5,200	5,200	15,100	3,900	.29	.27	.27	.25	.23	.23
13	Misc. steel work, lb	2,000	2,000	18,000	1,000	.25	.25	.25	.20	.18	.18
14	4-in. gate valves, 150-lb. pressure, each	3	8	.....	2	22.90	.....	22.90	22.50	22.50	22.50
15	" " " 250-lb. " "	12	12	10	8	28.90	28.90	28.90	31.00	31.00	31.00
16	6-in. " " 150-lb " "	30	14	.....	6	40.75	.....	40.75	33.50	33.50	33.50
17	" " " 250-lb. " "	2	2	4	2	56.40	56.40	56.40	49.00	49.00	49.00
18	8-in. " " 150-lb. " "	6	6	.....	2	60.31	.....	60.35	52.40	52.40	52.40
19	" " " 250-lb. " "	6	6	4	8	85.10	85.10	85.10	72.50	72.50	72.50
20	4-in. vacuum valves, 150-lb. pressure, each	4	8	.....	2	113.45	.....	113.45	125.00	125.00	125.00
21	" " " 250-lb. " "	12	12	10	8	113.45	113.45	113.45	125.00	125.00	125.00
22	6-in. " " 150-lb. " "	26	10	.....	6	149.00	.....	149.00	180.00	180.00	180.00
23	" " " 250-lb. " "	2	2	4	2	149.00	149.00	149.00	180.00	180.00	180.00
24	Air release valves, 150-lb. pressure, each	12	12	.....	4	38.20	.....	38.20	40.00	40.00	40.00
25	" " 250-lb. " "	6	8	8	6	38.20	38.20	38.20	40.00	40.00	40.00
26	Steel frames and covers for valves, lb	25,000	20,500	.....	7,500	.13	.....	.16	.15	.15	.15
27	Cast iron manhole covers and fittings, lb	4,000	4,000	1,000	2,500	.14	.14	.14	.12	.12	.12
28	Corr. metal pipe culverts, lb	2,000	2,000	.....	1,000	.13	.....	.13	.09	.09	.09
29	Steel bolts, nuts and washers, lb	2,900	2,900	4,900	1,800	.17	.17	.17	.08	.08	.08
30	Steel castings, lb	2,000	2,000	27,500	500	.165	.165	.16	.40	.22	.22
31	Install fittings furnished by city, lb	7,500	7,500	5,000	2,500	.131	.131	.131	.04	.04	.04
32	Install meter and valves furn. by city, lb	70,000	70,000	230,000	75,000	.043	.043	.043	.035	.035	.035
33	Install misc. metal work furn. by city, lb	7,500	7,500	5,000	2,500	.053	.053	.053	.05	.05	.05
34	Earth excavation for pipe trench, cu. yd	144,000	175,000	500	75,000	.76	1.00	.76	.70	.82	.70
35	Rock " " " " cu. yd	9,500	11,200	.....	3,800	1.40	.....	1.40	.95	1.25	1.25
36	Earth excavation for structures, "	700	700	400	300	1.90	2.00	1.90	1.50	1.50	1.50
37	Rock " " " "	400	400	.....	200	2.90	.....	2.90	2.50	2.50	2.50
38	Earth embankment fill, cu. yd	9,500	9,500	800	2,500	.60	.70	.60	.65	.70	.70
39	Concrete, Class A, cu. yd	750	720	20	180	24.00	28.00	24.00	25.00	25.00	25.00
40	" " B " "	150	160	.....	30	20.00	.....	20.00	22.00	22.00	22.00
41	" " C " "	.....	.....	520	.....	.....	25.00	25.00	.....	18.00	18.00
42	Extra cement, bbl	100	100	50	50	2.50	3.00	2.50	2.30	2.50	2.50
43	Reinforcing steel, lb	96,000	100,000	17,000	23,000	.05	.05	.05	.05	.05	.05
44	Structural steel, lb	56,000	56,000	136,000	.....	.09	.09	.09	.....	.085	.08
45	Valve house, lump sum	.....	.....	.....	1	.....	.....	.....	3,500.00	3,500.00	3,500.00
46	Misc. timber, Douglas Fir, M f b m	10	10	60	5	65.00	70.00	65.00	85.00	85.00	85.00
47	" " Redwood "	10	10	25	5	90.00	100.00	90.00	98.00	98.00	98.00
48	Painting misc. structures, sq. yd	500	500	300	300	.60	.60	.60	1.00	1.00	1.00
49	62-in. steel cyl. reinf. conc. pipe, 400 ft. head, lin. ft.	.....	47,570	.....	23,810	.....	.....	.....	21.05	21.05	20.50
50	62-in. steel cyl. reinf. conc. pipe, 300-ft. head, lin. ft.	.....	3,250	.....	1,720	.....	.....	.....	19.95	19.95	19.50
51	62-in. " " " " 200-ft. " "	.....	9,850	.....	360	.....	.....	.....	18.50	18.50	18.00
52	Tension joints for 62-in. conc. pipe, each	.....	170	.....	80	.....	.....	.....	10.00	10.00	8.00
53	¼-in. Gunite encasement on steel pipe, sq. ft	.....	9,000	.....	10,000	.....	.....	.....	.20	.20	.16

sections, all sections or any combination of sections. Following are complete unit prices of several bidders, including the successful contractor. Twenty firms submitted bids, but the tabulation shows prices of only six, selected at random to show the way the bids were running.

UNIT PRICES OF SEVERAL BIDDERS, MISSISSIPPI RIVER LEVEES, VIDALIA POINT, LA.

Contractors:
1—H. B. Banks, Tallulah, La. (Awarded contract all Sections).
2—W. E. Callahan Const. Co., Dallas, Tex.
3—Valley Construction Co., Vidalia, La.
4—Hardwick & Horton, Memphis, Tenn.
5—Mark C. Walker & Son Co., Omaha, Nebr.
6—J. H. Boyce Sons Co. & Roy L. Igo, Baton Rouge, La.

Quantities:

Section A—New and enlargement: 500,000 cu.yd.
Section B—Riverside enlargement: 550,000 cu.yd.
Section C—New and enlargement: 490,000 cu.yd.
Section D—New and enlargement: 380,000 cu.yd.
Section E—All new levee: 620,000 cu.yd.
Section F—New and enlargement: 430,000 cu.yd.
Total all sections: 2,970,000 cu.yd.

UNIT PRICES: NOTE—ALL PRICES INCLUDED IN PARENTHESES ARE ON BASIS OF TAKING ALL SECTIONS SHOWN OR NONE

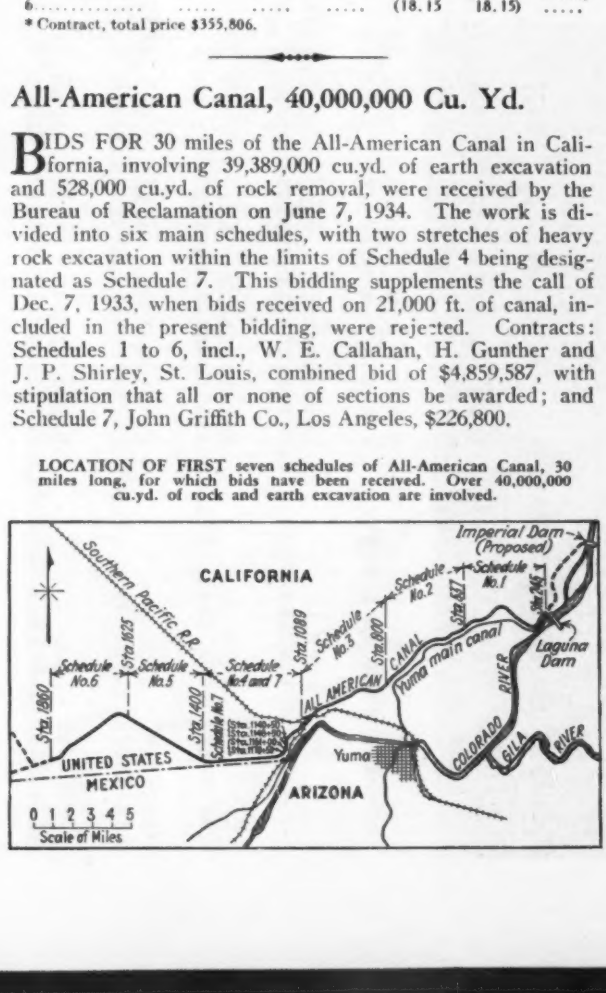
Contractor	Unit Prices (Cents per cu. yd.)					
	Sec. A	Sec. B	Sec. C	Sec. D	Sec. E	Sec. F
1*.....	(11.98	11.98	11.98	11.98	11.98	11.98)
2.....	(15.00	15.00	15.00	15.00	15.00	15.00)
2.....	(15.00	15.00	15.00	15.00)	.....	.....
2.....	(12.75	12.75	12.75)	.....	.....	.....
3.....	13.20	13.70	13.70	23.23	13.37	12.32
3.....	.....	(14.00	14.00	14.00)	.....	.....
3.....	.....	.....	.....	(14.30	14.30	14.30)
4.....	13.63	13.34	13.00	23.87	15.83	12.87
4.....	(12.19	12.19	12.19)	.....	.....	.....
4.....	(12.13	12.13	12.13	.....	.....	12.13)
4.....	(12.17	12.17	12.17	23.83	15.81	12.17)
5.....	18.20	17.20	18.20	31.75	17.50	18.60
5.....	(14.94	14.94	14.94	14.94	14.94	14.94)
5.....	(13.92	13.92	13.92)	.....	(15.25	15.95)
5.....	(14.18	14.18	14.18	.....	14.18	14.18)
6.....	12.78	13.78	14.50	28.75	12.78	13.74
6.....	.....	.....	.....	(15.90	15.90	15.90)
6.....	.....	.....	.....	.....	(12.78	12.78)
6.....	.....	.....	.....	(18.15	18.15)	.....

* Contract, total price $355,806.

All-American Canal, 40,000,000 Cu. Yd.

BIDS FOR 30 miles of the All-American Canal in California, involving 39,389,000 cu.yd. of earth excavation and 528,000 cu.yd. of rock removal, were received by the Bureau of Reclamation on June 7, 1934. The work is divided into six main schedules, with two stretches of heavy rock excavation within the limits of Schedule 4 being designated as Schedule 7. This bidding supplements the call of Dec. 7, 1933, when bids received on 21,000 ft. of canal, included in the present bidding, were rejected. Contracts: Schedules 1 to 6, incl., W. E. Callahan, H. Gunther and J. P. Shirley, St. Louis, combined bid of $4,859,587, with stipulation that all or none of sections be awarded; and Schedule 7, John Griffith Co., Los Angeles, $226,800.

LOCATION OF FIRST seven schedules of All-American Canal, 30 miles long, for which bids have been received. Over 40,000,000 cu.yd. of rock and earth excavation are involved.



SCHEDULES AND QUANTITIES, ALL-AMERICAN CANAL

Schedule 1—Sta. 245 to Sta. 537:
a—1,290,000 cu.yd. common excav. (245 to 324)
b—4,225,000 cu.yd. common excav. (324 to 537)
c—10,000 cu.yd. rock excav.
d—34,000 cu.yd. common excav. (Yuma Canal)
e—13,000 cu.yd. rock excav. (Yuma Canal)
Schedule 2—Sta. 537 to Sta. 800:
5,800,000 cu.yd. common excavation.
Schedule 3—Sta. 800 to Sta. 1089:
6,100,000 cu.yd. common excavation.
Schedule 4—Sta. 1089 to Sta. 1400 (except Sched. 7):
a—7,150,000 cu.yd. common excav.
b—5,000 cu.yd. rock excav.
Schedule 5—Sta. 1400 to Sta. 1625:
7,650,000 cu.yd. common excavation.
Schedule 6—Sta. 1625 to Sta. 1860:
7,100,000 cu.yd. common excavation.
Schedule 7—Sta. 1140 + 50 to Sta. 1148 + 50 and Sta. 1161 to Sta. 1170 + 50:
a—40,000 cu.yd. common excavation.
b—500,000 cu.yd. rock excavation.

BIDDERS AND SUMMARY OF BIDS BY SCHEDULES

A—W. E. Callahan, H. Gunther & J. P. Shirley, St. Louis: Sched. 1—$712,837; Sched. 2—$710,500; Sched. 3—$747,250; Sched. 4—$882,125; Sched. 5—$937,125; Sched. 6—$869,750; Total—$4,859,857.*
B—Geo. Pollock Co., Sacramento, Cal.: Sched. 1—$911,020; Sched. 2—$722,680; Sched. 3—$745,420; Sched. 4—$771,695; Sched. 5—$682,380; Sched. 6—$687,280; Sched. 7—$378,000.
C—Canal Const. Co., Los Angeles: Sched. 1—$918,000; Sched. 2—$812,000; Sched. 3—$854,000; Sched. 4—$1,005,000; Sched. 5—$765,000; Sched. 6—$710,000; Sched. 7—$385,000; Total—$5,449,000 (will accept all or none).
D—Foley Bros. Co., St. Paul: Schedule 4—$929,850; Sched. 5—$757,350; Sched. 7—$286,200.
E—S. S. Magoffin, Adrian, Ore.: Sched. 1—$1,183,575; Sched. 4—$639,200; Sched. 7—$757,000.
F—E. Peterson & M. C. Walker, Omaha: Sched. 1—$1,739,740; Sched. 2—$1,450,000.
G—Sternberg Dredging Co., St. Louis: Sched. 5—$841,500; Sched. 6—$887,500.
H—W. W. Kettlewell & C. A. Spicer, Oakland, Cal.: Sched. 5—$1,080,562; Sched. 6—$1,073,875.
I—Mark C. Walker & Son, Omaha, Nebr.: Sched. 5—$1,067,940; Sched. 6—$1,150,200.
J—John Griffith Co., Los Angeles; Sched. 7—$226,800.*
K—Jahn & Bressi, Los Angeles: Sched. 7—$249,500.
L—S. H. Palmer, San Francisco: Sched. 7—$253,000.
M—White & Miller, Yuma, Ariz.: Sched. 7—$296,500.
N—Paul J. Taylor, Oreville, Calif.: Sched. 7—$312,700.
O—Sharp & Fellows, Los Angeles: Sched. 7—$316,000.
P—V. R. Dennis, San Diego, Cal.: Sched. 7—$337,500.
Q—West Const. Co., Los Angeles: Sched. 7—$359,600.
R—Yale & Reagan Co. & Benson Kaiser, St. Louis: Sched. 7—$456,000.

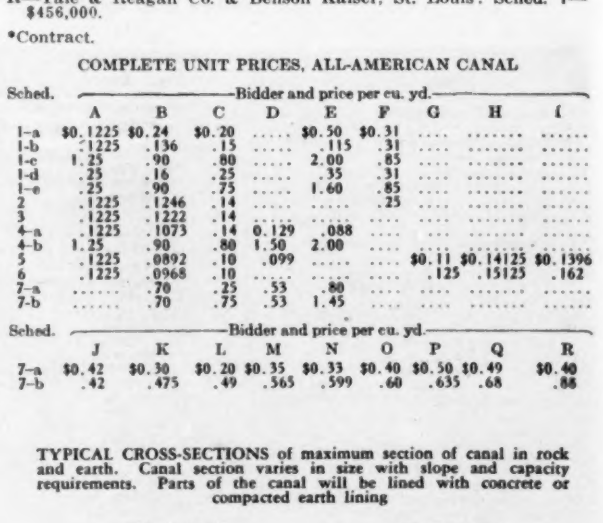
*Contract.

COMPLETE UNIT PRICES, ALL-AMERICAN CANAL

Sched.	Bidder and price per cu. yd.								
	A	B	C	D	E	F	G	H	I
1-a	$0.1225	$0.24	$0.20	.....	$0.50	$0.31	....	.....	.....
1-b	.1225	.136	.15	.....	.115	.31	....	.....	.....
1-c	1.25	.90	.80	.....	2.00	.85	....	.....	.....
1-d	.25	.16	.25	.....	.35	.31	....	.....	.....
1-e	.25	.90	.75	.....	1.60	.85	....	.....	.....
2	.1225	.1246	.14	.....	.....	.25	....	.....	.....
3	.1225	.1222	.14	.....	.....	....	....	.....	.....
4-a	.1225	.1073	.14	0.129	.088	....	....	.....	.....
4-b	1.25	.90	.80	1.50	2.00	....	....	.....	.....
5	.1225	.0892	.10	.099	.....	....	$0.11	$0.14125	$0.1396
6	.1225	.0968	.10	.....	.....	....	.125	.15125	.162
7-a	.....	.70	.25	.53	.80	....	....	.....	.....
7-b	.....	.70	.75	.53	1.45	....	....	.....	.....

Sched.	Bidder and price per cu. yd.								
	J	K	L	M	N	O	P	Q	R
7-a	$0.42	$0.30	$0.20	$0.35	$0.33	$0.40	$0.50	$0.49	$0.40
7-b	.42	.475	.49	.565	.599	.60	.635	.68	.88

TYPICAL CROSS-SECTIONS of maximum section of canal in rock and earth. Canal section varies in size with slope and capacity requirements. Parts of the canal will be lined with concrete or compacted earth lining



CONSTRUCTION REPORTS

WATERWORKS

PROPOSED WORK

Ariz., Phoenix—City made plans and soon takes bids 15 mi. 2- to 12-in. c.i. water project. $100,000. W. C. Lefebvre, city mgr. Noted Jan. 18.

Calif., Santa Cruz—City, R. S. Tait, city water supt., plans 14 in. watermain in Davis St. to replace 2 in. line now in place. $15,000 or more. City to provide funds.

Colo., Manitou — City voted bond issue to secure P.W.A. loan, for financing replacing 6 in. waterworks pipe with 10 in. pipe, and relaying 8 in. pipe. $25,000. A. O. Maltby, Manitou, engr. Noted June 7.

Fla., Trenton — Municipality plans waterworks improvements, incl. storage, pumping, and distribution, etc. $40,000.

Idaho, Mountain Home—City plans rebuilding municipal water system. $43,000. $36,000 P.W.A. grant contingent on city employing competent engineer to prepare plans and specifications. Noted Jan. 18.

Kan., Sedan—City, plans awaiting approval of P.W.A. for waterworks system. $80,000. Black & Veatch, 700 Mutual Bldg., Kansas City, Mo., engrs. Noted Oct. 12.

Minn., Willmar—City making plans 2,935 lin.ft. watermains, six 10 in. and ten 4 in. gate valves, two 6 in. hydrants, valves, etc. also 100,000 gal. storage tank. $20,000. Pillsbury Eng. Co., 1200 2nd Ave. S., Minneapolis, engrs.

O., Toledo—New revised plans for waterworks extension, consisting of pumping station, filter plants and mains, now approved by L. A. Boulay, engr. Ohio P.W.A. and F. H. Waring, ch. engr. Ohio Bd. Health, and application sent to Washington for approval by P.W.A. $8,500,000. Noted Dec. 1.

Ore., Newberg—Election July 10, $417,500 to purchase pipe for new watermain from Otis Springs to city. S.E.R.A. project.

Tex., Austin—Revenue bonds in sum of $857,000 to secure PWA loans for water and sewer improvements were authorized by vote of 3 to 1 in recent special election. Projects to be constructed under P.W.A. program, include new sewage disposal plant, new settling basin of at least 4 m.g.c. at city filter plant, new sewer line extensions, new water line extensions, high pressure pump at city water plant, new service building and central garages at water and light plant, all to be financed with loan from P.W.A. up to $857,000 and a grant of at least $246,000. Loan is to be retired from earnings of water and light plant over 10 year period. Noted May 24.

Tex., Hallettsville—City voted $23,000, waterworks improvements. Est. $29,000. P.W.A. project. Terrell Barthett Engineers, Smith-Young Tower, San Antonio, engrs. Noted Mar. 8.

Tex., Houston—City, c/o O. F. Holcombe, mayor, defeated $2,502,000, waterworks improvements. O. F. Holcombe, mayor, announced that he would endeavor to put through project in some other manner. Noted Dec. 7.

Tex., Houston—Houston Gardens, Inc., 3209 Gulf Bldg., rejected bids steel tank and tower Owner probably will build, furnishing all labor, tools and/or equipment necessary for erection and completion of steel tower and water tank. Noted May 10.

Tex., Port Lavaca—City, c/o F. M. Budgeon, mayor, election July 10, $43,000 waterworks improvements; $42,000 sanitary sewerage system. Election in June on $42,000 withdrawn.

Utah, Salt Lake City—City plans 6,000 ft. pipe line from Big Cottonwood conduit to head of Tanner Ditch. $18,000. W. D. Beers, city engr. Noted Nov. 9.

Ont., Trenton—Town plans laying 1½ mi. 12 in. pipe line to supply water to town. $10,000-$15,000. Well already drilled.

Que., St. Lambert—M. J. Rutledge, city engr., preparing plans waterworks extension.

BIDS ASKED

Ark., Mt. Ida—July 5, by Town, F. Edwards, mayor, Contr. A, drilling casing, developing and testing deep well to supply 150 G.P.M., together with pump, motor and all appurtenances; Contr. B, incl. remainder of system, involving 2, 4 and 6 in. c.i. pipe and specials, fire hydrants, valves and service connections, elevated tank, pumphouse, booster pump, etc. $47,000. F. A. Pritchett, 701 Wallace Bldg., Markham and Main Sts., Little Rock, engrs.

Calif., San Francisco — July 6, by Public Utilities Comn., constructing Sunset Reservoir pipe line, involving 8,900 ft. 54 in. steel pipe with asphalt dip or 51 in. steel pipe with spun lining or 51 in. rein.-con. pipe. Noted June 7.

Calif., San Francisco—July 6, by F. Taylor, secy. P. Utilities Comn., City Hall, laying University Mound Pipe line extension in Potrero Ave. from 25th to Brannan Sts., Spec. W.D. 62, involving (1) removal and delivery of steel pipe from Newark-San Lorenzo pipe line to San Francisco, 2,200 lin.ft. 44 in. and 4,200 lin.ft. 36 in. pipe (2) excavation, excess removal, backfill, etc., for trench, 2,200 lin.ft. trench for 44 in. and 4,200 lin.ft. trench for 36 in. pipe (3) additional excavation, backfill, excess removal, etc., 400 cu.yd. (4) additional pavement removal and replacement, 1,000 sq.ft. (5) installation of pipe, making of field joints, cleaning up, etc. (6) installation of fittings, gate valves, air valves, etc., 20,400 lb. (7) additional field joints, incl. preparation, handling, making and lining and coating of joints, 150 lin.ft. (8) insulation 7 joints, incl. material, preparation of pipe, making and installation of joint, wrapping and lining of joints.

Ill., Arlington Heights — July 9, by City, deepening 1 well, 6,800 ft. water main extension and booster station; 4 meters for 4 existing wells; 1 tank and tower; leakage waterway survey. $50,000. Consoer, Townsend, Older & Quinlan, 205 North Wells St., Chicago, consult. engrs. P.W.A. project. Noted Feb. 18.

†Md., Aberdeen—July 6, by Con. Q.M., Aberdeen Proving Ground, watermains, sanitary and storm sewers, at Aberdeen Proving Ground.

Nev., Lovelock—July 9, by City, V. A. Twigg, clk., constructing water supply pipe line with well and pumping plant and materials. $95,000. King & Malone, 29 East 1st St., Reno, engr. Noted Aug. 31.

N. Y., Guilderland—July 3, by Commissioner Health, State Office Bldg., Albany, water supply for state laboratory farm. Proposal 1, $17,256. Proposal 2 $16,056.

O., Hamilton—July 12, by City Manager, Contr. 4, water supply, softening and filtration plant, and appurtenances on land owned by city in Sect. 21, 28, T2N, R3E, St. Clair Twp., Butler Co., and power transmission line from said plant to Hamilton municipal electric plant. Barstow & Le Feber, Inc., 31 North Summit St., Akron, engrs.

S. C., Mt. Pleasant—July 10, by Town, waterworks system. Est. $75,000. Financed by P.W.A. loan. J. E. Gibson, Charleston, engr. Noted June 21.

Tex., Amarillo—July 10, by City, c/o City Manager, constructing 5 m.g. underground concrete reservoir, 20 in. duplicate supply main and distribution mains in mercantile district. P.W.A. project. H. R. Smith, Amarillo, engr. Noted June 14.

Tex., Farmersville—City, bids about July 6, waterworks improvements, incl. construction of dam and reservoir, involving placing of 50,000 cu.yd. earth and other material and laying 3,500 ft. c.i. pipe. $51,000. P.W.A. project. Myers, Noyes & Forrest, 2203 Tower Petroleum Bldg., Dallas, engrs. Noted June 7.

CONTRACTS AWARDED

Calif., San Francisco—Public Utilities Comn., City Hall, constructing Bay Crossing Pipe Line 2, in connection with Hetch Hetchy Project under contract and Specification Dpt. No. 46, involving 20 mi. pipe line, 5 mi. concrete pipe (steel cylinder) 62 in. inside diam., 15 mi. steel pipe, 66 in. inside diam., from ⅜ in. to 7/16 in. thick, 3,870 ft. 76 in. inside diam. steel pipe, for City and San Francisco Co., to Western Pipe & Steel Co. of California, 444 Market St., Proposal 1, Sects. A and B, welded steel pipe, $1,732,438***to American Concrete & Steel Pipe Co., 19th and Estuary Sts., Oakland, Sect. C, $638,969. Est. $2,250,000. Bids June 12. Noted June 7.

Colo., Longmouth — City, filtration plant equipment, incl. floculator and clarifier, etc., to Door Controlling & Equipment Co. Agency, (W. A. Steel & Co.), 302 East 4th St., Los Angeles, Calif., $5,150***valves, to D. E. Kepner, 1921 Blake St., Denver, $2,477*** controls and tables, to E. W. Bacharach & Co., Rialto Bldg., Kansas City, Mo., $5,047*** elevated tank, to Chicago Bridge & Iron Co., 37 West Van Buren St., Chicago, Ill., $3,300 ***dry chemical feeders, to International Filter Co., 1921 Blake St., Denver, $630***water pressure unit, to Crane, O'Fallon Co., 1631 15th St., Denver, $126***wash water pump, to Lindrooth-Shubart Co., Boston Bldg., Denver, $665. Grand total $17,395. Bids May 29.

Ill., Peoria Heights—Village, 300,000 gal. concrete reservoir, to Mehlenbeck Bros., Peoria, $23,798***two 16 in. wells, 120 ft. average depth, to M. Ebert Co., Washington, $4,080*** 5,000 lin.ft. 16 in. c.i. pipe, to J. B. Clow & Sons, 201 North Talman Ave., Chicago, $14,342 ***turbine type pumps, to American Well Wks., Aurora, $6,202***horizontal centrifugal pumps, to Hagerty Bros. Co., Inc., 923 South Washington St., Peoria, $2,169***hauling pipe, to R. C. Oktanski Co., Peoria, $313. Grand total $50,905. **P.W.A.** Bids Mar. 19. Noted Mar. 8.

Kan., Coffeyville—City, water softening plant, to Universal Constr. Co., Coffeyville, $38,960. Noted Jan. 11.

Mass., Abington—Town, improving water supply system, watermains, foundation and domestic connections. Owner builds, G. Gonley, Town Hall, in charge, $26,000. Awarded June 1. Noted Nov. 16.

N. Y., New York—Bd. Water Supply, 345 Bway., bronze gate valves and test riser valve controlling mechanism, to Bartwood Haywood Co., 200 Scott St., Baltimore, Md., $253,545 and $93,138 respectively***steel and iron valves, to Western Gas Constr. Co., 60 East 42nd St., $138,798***bronze high pressure centrifugal pumps, to Lee Courtenay, 75 West St., $55,708***hydraulic cylinder pumps, etc., to Hardie Tynes Mfg. Co., 220 Bway., $94,549 ***traveling cranes, hoists and trolleys, to Shaw Box Crane & Hoist Co., 405 Lexington Ave., $25,177***hoist cages, wire ropes, sheaves, reel and appurtenances for drainage shaft, to McKiernan Terry Corp., 15 Park Row, $29,686***transformers, switchboards, panel boards, air compressors, blower pumps, pump motors, to James Sugden Co., 67 West 44th St., $48,016***electric cables, conductors and appurtenances, to General Cable Co., 420 Lexington Ave., $12,451, all above for City Water Tunnel 2. Grand total $750,048. **P.W.A.** Bids June 11 and 12. Noted May 31.

N. Y., Perrysburg—City of Buffalo, drilling 2 wells for water supply for J. N. Adam Memorial Hospital in Perrysburg, to Sprague & Henwood, 221 West Olive St., Scranton, Pa., $31,900. Est. $70,000. Bids June 19.

N. C., North Wilkesboro—Mayor and Bd. Town Comrs., W. P. Kelly, clk., tower and tanks for waterworks awarded to R. D. Cole Mfg. Co., Newnan, Ga. Total est. $54,000. **P.W.A.** Noted May 31.

N. C., Southern Pines—See "Sewerage and Waste Disposal."

Pa., Polk—J. L. Hanna, Pennsylvania Dpt. Property & Supplies, Harrisburg, rein.-con. sedimentation basin, 25x53x13 ft. depth with 2 mixing chambers 10x25x14, membrane waterproofing, furnishing, installing rate controllers, centrifugal pumps, motor drive, dry feed chemical machine water meters and new water lines, to C. W. Tanner, Box 138, R. D. 9, South Hills Branch, Pittsburgh. $16,670. Est. $20,000. Bids May 23, awarded June 18.

†R. I., Quonset Point—U. S. Property & Disbursing Officer, c.i. pipe water system and clay pipe sewerage system at Camp Grounds, to Di Sandro Bros., 106 Langdon St., Providence, $8,700. Bids June 10. Noted June 7.

S. C., Columbia—Mayor and City Council, 33,508 ft. 6- to 20-in. c.i. pipe, 29 tons specials, 80 valves, 20 hydrants, to J. B. McCrary Co., 22 Marietta St., Atlanta, Ga., $108,600. Awarded June 8. Former contract rescinded. **P.W.A.** Noted June 14, under "Contracts Awarded."

S. C., Sumter—Town, water and sewer extension, to Boyle Road & Bridge Co., Sumter, $99,988. Est. $108,000. **P.W.A.** J. Palmer Sumter, engr.

S. D., Sioux Falls—City, drilling 2 wells, to A. Fanebust, 709 East 20th St., $13,886. Bids June 4. Noted Oct. 19.

†*Federal Government.*

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Waterworks (Continued)

Tenn., Sevierville—Mayor, 1 service pump house, 28,050 lin. ft. 2- to 8-in. pipe, valves, hydrants, etc., to W. L. Hailey & Co., Cotton States Bldg., Nashville, $45,361; 2 deep wells to Morris Well Drilling Co., Knoxville, $8,880. Bids June 20, awarded June 20. **P.W.A.**

SEWERAGE AND WASTE DISPOSAL

PROPOSED WORK

Ariz., Phoenix—City made plans and soon takes bids 51 mi. 8- to 21-in. sanitary sewer project, $350,000; 15 mi. 8- to 54-in. concrete storm drain, $270,000. W. C. Lefebvre, city mgr. Noted Jan. 4.

Ark., Hot Springs—City making plans sewerage system improvements. $300,000. Black & Veatch, 700 Mutual Bldg., Kansas City, Mo., engrs. Noted Dec. 21.

Calif., Midway City—Orange Co. plans constructing sanitary sewerage system and treatment plant, $95,000. Proposed S.E.R.A. project. Supervs. Orange Co. will be asked to call election for $25,000 to finance purchase of materials, S.E.R.A. to be asked for $70,000 for labor. G. L. Bates, 105 West 5th St., Santa Ana, engr.

Calif., San Jacinto—City plans sanitary sewerage system, materials $9,000. Est. $30,000. City council voted to apply to Riverside County S.E.R.A. for financing. Koebig & Koebig, Rowan Bldg., Los Angeles, engrs.

Ind., Goshen—City, C. E. Firestone, mayor, making plans and takes bids in 30 to 60 days, primary sewer disposal station, 2 intercepting sewers, and 2 booster stations, 25,400 ft. 15- to 84-in. tile and concrete sewers. $455,000. P.W.A. project. Bemis & Co., 105 West Adams St., Chicago, Ill., consult. engrs. Noted May 31.

Mich., Marquette—City, preparing plans surface water drainage system, incl. 8,000 ft. vitr. or concrete storm sewer and 8,000 ft. laterals, brick and concrete manholes. $80,000. Shoecraft, Drury & McNamee, Ann Arbor, engrs.

N. J., Oakhurst—Ocean Twp. plans sewer pumping station and sea outlet for Oakhurst, Lock Arbour, Wanamassa, Interlaken and West Allenhurst. $80,000. State Bd. Health approved plans. K. W. Seaman, Long Branch, engr. Noted May 3.

N. Y., Auburn—City, preliminary plans sewage disposal plant, $1,000,000. **Maturity in 1935.** J. J. Tehan, city engr.

N. Y., Ogdensburg—City plans garbage incinerator. $75,000. P. E. Clark, health officer to obtain cost of plans and construction.

N. Y., Rochester—City and Greece Twp. plan sanitary and storm sewers in eastern subdivisions of township. $500,000. H. Herrick, appointed engr., 2550 Ridge Rd., Rochester, will make special plans and specifications. K. Knapp, city sanitary engr.

O., Hicksville—City Council approved $45,000 bond issue for sewage treatment plant. $16,000 P.W.A. grant received. Est. $60,000. Plans completed and approved by State Bd. Health.

Ore., Portland—City plans sewage disposal plant. Applied for $2,200,000 outright gift from P.W.A. Application supplemented previous request for both the loan and grant of $6,000,000. Noted Oct. 12.

Tex., Austin—See "Waterworks."

Tex., El Paso—City soon takes bids 13 mi. 18- to 42-in. sanitary and storm sewers. $353,000. Black & Veatch, 700 Mutual Bldg., Kansas City, Mo., engrs. H. G. Stacy, El Paso, engr. Noted June 21.

Tex., Port Lavaca—See "Waterworks."

BIDS ASKED

La., Houma—July 18, by Bd. Aldermen and E. Wright, mayor, refuse incinerator of not less than 24 tons per 24 hr. capacity. P.W.A. project 1794. J. L. Porter and Earl Eng. Co., 2002 American Bank Bldg., New Orleans, consult. engrs. Noted Mar. 8.

Mass., Boston—July 9, by C. J. Carven, comr., City Hall Annex, concrete or vitr. clay sewerage lines in Walk Hill St.; July 10, in La Grange St., both West Roxbury; July 11, in Shepard Brook, Brighton. To exceed $25,000. Part of P.W.A. $1,000,000 loan and grant, Docket 4193.

Minn., Winona—July 19, by City, 10,200 ft. 18- to 42-in. intercepting sewer, sewage treatment plant, and pumping station. Greeley & Hanson, 6 North Michigan Ave., Chicago, Ill., engrs. P.W.A. project. Noted June 8, 1933.

O., Columbus—July 10, by W. J. Lucks dir. Serv., Contr. 11, Beulah Rd. Sanitary Sewer, involving 4,970 ft. 30- to 42-in. pipe, 19,700 cu.yd. excavating, 80,000 lb. billet steel reinforcing bars, 25,000 sq.ft. vitr. clay liner plates 3,370 ft. 10 in., 600 ft. 8 in. 1,000 ft. 6 in. vitr. clay sewer pipe $97,261. P.W.A. project. P. W. Maetzel, City Hall, engr.

O., Columbus—July 12, by W. J. Lucks, dir. Serv., Contr. 2, sewage disposal plant, sludge filter station, South Side Section, involving 700 cu.yd. excavating, vacuum filter and auxilliary sludge elevator, chemical feeders, conditioning tanks, filter coke conveyors, and mechanical weighing devices, ferric chloride, storage tanks, sludge mixing and settling tanks. P.W.A. project. P. W. Maetzel, City Hall, engr.

S. C., Columbia—July 6, by City Council, furnishing all labor, materials, equipment, etc. for constructing certain complete extensions to sanitary sewerage system, involving 102 manholes, 44,741 ft. 18- to 36-in. concrete or vitr. clay pipe, known as Gill Creek outfall. $200,000. This is 3rd city water and/or sewer extension project to be completed with $893,000 P.W.A. loan and grant. W. S. Tomlinson, City Hall, engr. Noted Nov. 23.

Tex., Dallas—July 18, by City Council, storm drainage system in levee district. $319,000. Will be partly financed by a $96,000 Federal grant. Noted Feb. 1.

Tex., San Antonio—July 9, by Bexar Co. Water Control & Impvt. Dist. 3, c/o A. M. Scholtz, 205 Lee Hall St., San Antonio, constructing collecting system to connect to city of San Antonio sewerage system, Los Angeles Heights, involving 145,117 ft. 6- to 15-in. salt glazed vitr. clay pipe, incl. 21,800 ft. 6 to 15 in. double strength pipe, 100 cu.yd. rock trenching, manholes, tees, wyes, etc. Est. $158,000. J. W. Beretta Engineers, Inc., 103 National Bank of Commerce Bldg., engrs.

Va., Christiansburg—July 3, by Town, at office R. L. Miller, clk., sanitary sewerage system, incl. 50,663 lin. ft. 60- to 20-in. sewer pipe; 300 lin. ft. 8- to 12-in. c.i. pipe; 2,500 cu.yd. rock excav., settling tank; sludge drying bed; 3,250 lin. ft. 1½ in. galvanized pipe; 741 wye branches; 160 manholes. J. B. McCrary Eng. Corp., Atlanta, Ga., engrs. Noted June 7.

Wis., Madison—Madison Metropolitan Sewer Dist. bids about July 25. Nine Springs Sewage Treatment Plant addition, Dane Co. Mendota Dist. $600,000. Greeley & Hanson, 6 North Michigan Ave., Chicago, Ill., engrs. Noted Jan. 4, 1933.

CONTRACTS AWARDED

Colo., Denver—City Engineer, City and County Bldg., constructing storm sewers in West Denver Storm Sewer Dist. 3, to J. S. Schwartz Constr. Co., Mining Exch. Bldg., Colorado Springs, $66,914. Bids June 11, awarded June 15.

Me., Portland — City, W. O. Thompson, purch. agt., City Hall, constructing section of Edwards St. Storm Water Intercepting Sewer, concrete pipe, P.W.A. Project Proposal 3727, to G. Casale, 163 Veranda St., $38,757. **P.W.A.** Noted May 17.

N. H., Hinsdale—Town, A. Krumenaker, chn. Comn. Water Supply & Sewerage, Town Hall, sanitary sewerage system, involving vitr. clay pipe, P.W.A. Project Docket 4405, to C. L. Hosmer, Greenfield, Mass., $47,260. **P.W.A.** Bids June 14, awarded June 21. Noted June 7.

N. Y., Geneva—City, sewage treatment plant, to Hemmerich, Kuhs & Bender, 63 Highland Parkway, Rochester, $143,429. **P.W.A.** Bids June 7. Noted May 17.

N. C., Southern Pines—Town, sewage treatment plant, to Elliott Building Co., Hickory, $25,234•••6 in. waterlines, to Boyd & Goforth, Charlotte, $11,080•••200 gal. tank, to R. D. Cole, Newman, Ga., $600. Grand total $36,914. Est. $42,000. **P.W.A.** Noted Apr. 19.

O., Columbus—W. J. Luck, dir. Service, 1st contract on sewage disposal plan, aeration tanks and pipe gallery, 2,000 ft. 8 in. vitr. clay sewer pipe, 30,000 cu.yd. excav., 2,000 cu.yd. general embankment, 6,000,000 lb. steel reinforcing bars, 49,000 sq.ft. precast concrete walk slabs, 17,000 lb. sheet copper expansion joints, 35,000 lb. miscellaneous steel and wrought iron, 46,000 lb. iron castings to Bryant & Detwiler Co., 2304 Penobscot Bldg., Detroit, Mich., billet steel $867,541. **P.W.A.** Bids June 5. Noted Apr. 12.

†O., Dayton—Vet. Administration, Wash., D. C., incinerator at National Military Home, to T. J. Egan & Co., 70 Kane St., Buffalo, N. Y., $5,300. Est. $6,500. Bids May 8. Noted Apr. 19.

Pa., Kennett Square—Borough, general contract sewage treatment plant, to D. M. Hunt, 1700 Sansom St., Phila.•••mechanical work, to Roberts Filter Mfg. Co., Darby•••electrical work, to Elias Nusbaum & Bro., Inc., 2023 Sansom St., Phila.•••heating, to John Borden & Bros., 637 North 19th St., Phila.•••sewerage system, to R. Di Vito, 6314 Dicks St., Phila. Est. $83,657. Bids May 31. Noted May 17.

†Pa., Middletown—Con. Q.M., Middletown Air Depot, sanitary storm sewers and water lines, to R. E. Wolfe, 1725 Market St., Harrisburg, $20,974. Bids May 28. Noted May 24.

S. C., Sumter—See "Waterworks."

Tenn., Sevierville—Mayor, sewerage system, to G. M. Ferris, Athens, $23,902. Est. $32,000. **P.W.A.**

BRIDGES AND GRADE CROSSINGS

PROPOSED WORK

Massachusetts—Cities of Boston and Chelsea and Commonwealth of Massachusetts, plan rebuilding existing Chelsea North Bridge, structural steel over Mystic River $270,000. City of Boston to appropriate $80,000, City of Chelsea $55,000 and State $135,000 toward cost.

N. Y., Buffalo—Erie R.R. Co., G. S. Fanning, ch. engr., Midland Bldg., Cleveland, O., and Lehigh Valley R.R. Co., G. T. Hand, ch. engr., 143 Liberty St., New York, plans eliminating William and South Ogden Street Crossings and Queens Street Bridge. Public Service Comn. approved general plan of construction, track detour and estimated cost of $96,100. The Commission authorized Lehigh Valley R.R. to do certain work by direct employment of labor and purchase of material amounting to $32,815.

N. Y., Champlain—Delaware & Hudson R.R. Co., J. McMartin, ch. engr., Albany, soon takes bids eliminating grade crossing. Pub. Serv. Comn. approved, $117,000 cost and specifications. Changes in telegraph lines, to Western Union Telegraph Co., 60 Hudson St., New York, part of work by day labor to extent of $12,000. Noted Feb. 16.

N. Y., Valley Stream and Lynbrook—Long Island R.R. Co., A. C. Watson, ch. engr., Pennsylvania Sta., New York, revised general plans and cost approved by Pub. Serv. Comn. for plans eliminating grade crossings at Rockaway and Merritt Rds., Franklin, Rockaway and Scranton Aves., in Valley Stream; Bway., Horton, Wright, Atlantic, Forest, Earle, Denton, Rocklyn and Ocean Aves., in Lynbrook, $4,413,098. Noted Oct. 26.

N. Y., West Seneca—Pennsylvania R.R., T. J. Skillman, ch. engr., Broad St. Sta., Phila., Pa., and New York Central R.R. Co., J. Pfau, ch. engr., 466 Lexington Ave., New York, eliminating Orchard Park Crossing may be deferred for approximately another year, but owners should prepare all necessary plans, specifications and estimates of cost and submit them to Public Service Comn. for approval not later than June 1, 1935. Noted Oct. 6, 1932.

Tex., Fort Worth—Texas & Pacific R.R. Co., c/o J. L. Lancaster, pres., Texas & Pacific Bldg., Dallas, and St. Louis, San Francisco R.R., c/o J. M. Kurn, St. Louis, Mo., and City of Fort Worth, c/o G. D. Fairtrace, mgr., Fort Worth, revising plans 150 ft. viaduct over Texas & Pacific and Frisco R.R. tracks on Ballenger St., $105,000; 254 ft. reinforcing steel viaduct over railroad tracks, Daggett St. $250,000. P.W.A. project. Noted Mar. 29.

Wash., Tacoma—Pierce County Tacoma Narrows Bridge Co. plans Narrows Bridge. Plans approved by P.W.A. and placed in preferred position for final step for allocation of funds. Noted Jan. 25.

Ontario — Thousand Island Bridge Comn., Elton H. Miller, chn., Pamelia, N. Y., plans bridge Joy Lea Cut. Est. $2,000,000. Robinson & Steinman, 117 Liberty St., New York, and Monsarrat & Pratley, 1117 St. Catherines St. W., Montreal, Que., consult. engrs.

BIDS ASKED

Indiana—July 10, J. D. Adams, chn. State Hy. Comn., Indianapolis, constructing Structure 52-K-1659 over Indianapolis Water Co. Canal at 16th and Wests Sts., Indianapolis, Marion Co.; Structure 39-K-1604 over Tippecanoe River, on State Rd. 39, NRH 351-A, south of Monticello, Carroll and White Counties; Structure 50-2010 over Baltimore & Ohio R.R., on State Rd. 50, NRHM Project 156-D, near Brownsville, Jackson Co.; Structure 32-6-1648 over Heath Ditch, State Rd. 32, 32-C-1648, Boone Co.; repairing floors Structure 50-Q-1676, over Hogan Creek, on State Rd. 501 NRM 325-B, in Aurora, Dearborn Co.

Maryland—July 3, by State Roads Comn., Baltimore, triple span steel girder bridge over tracks of Baltimore and Ohio R.R., on Phila. Rd. relocation, near Golden Ring. Contr. B-316-2-48, Federal Aid Project N.R.H. 335-C, Baltimore Co.

Minn., Jordan—July 18, by T. H. Walsh, and Scott Co., Shakopee, constructing steel bridge over Minnesota River, Scott and Carver Counties. $60,000.

Missouri—July 6, by State Hy. Dpt., Jefferson City, bridges over Dry Branch Yodkin Creek, Steelville South, Crawford Co.; over Gasconade River and over Gasconade River Overflow, Route 28, Dixon South, Pulaski Co.; over Little Beaver Creek, Route B to Christian Co., Douglas Co. T. H. Cutler, state hy. engr.

New Hampshire and Vermont — July 6, by State Hy. Dpts. of New Hampshire at Concord, and Vermont at Montpelier, 5 span 526 ft. deck plate girder bridge and approaches over Connecticut River between Littleton, N. H., and Waterford, Vt. $120,000. J. W. Childs, Concord, N. H., engr.

New Jersey—July 9, by State Hy. Comn., Trenton, constructing bridge over right-of-way of Central R.R. of New Jersey and bridge over right-of-way of Lehigh Valley R.R., on Route 29, Sect. 11, incl. 500 cu.yd. found. excav. A. L. Grover, ch. clk.

Oklahoma—July 10, by State Hy. Dpt., Oklahoma City, 8 span, 240 ft. I-beam bridge on concrete piers, near Wapanucka, Coal Co. $27,000. C. L. Wilson, state hy. engr.

†S. C., Charleston—July 12, by U. S. Eng., constructing swing span highway bridge with road approaches across Intracoastal Waterway, near Little River.

†S. C., Little River—July 12, by U. S. Eng., Charleston, swing span highway bridge with road approaches and detour across Intracoastal Waterway, 3 mi. south of here.

Washington—See "Streets and Roads."

†*Federal Government.*

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Bridges, etc. (Continued)

CONTRACTS AWARDED

Arkansas—State Hy. Comn., Little Rock, W. W. Zass, engr., constructing 6 bridges on Walnut Ridge-Paragould Rd., Lawrence and Greene Counties, Job 5162, to Vincennes Bridge Co., Vincennes, Ind., $65,408. Est. $100,000.

California — State Hy. Comn., Sacramento, bridge consisting of six 108 ft. plate girder and two 73 ft. 6 in. end spans on concrete piers over Sacramento River, Redding, Shasta Co., to J. F. Knapp, 1401 Park Ave., Oakland, $168,847. Bids June 13, awarded June 15. Noted May 31.

†Colorado—Pub. Bds., Denver, Colo., bridge in Eagle Co., to Homer & Switzer, Arvada, $70,987. Bids June 4, awarded June 14.

Colorado—State Hy. Dpt., Denver, bridge and overpass on hy. west of Limon on Colorado Springs Rd., U.S.P.W. Project N.R.H. 79-G, Div. 1, Elbert and Lincoln Counties, to Babb & Thorklidson, 1507 13th Ave., Greeley, $77,493. P.W.A. Bids June 5.

Illinois—Dpt. P. Wks., Div. Hys., Springfield, C.B. & Q. R.R. subway in DuPage Co., to E. D. Otto, Downers Grove, $52,958***superstructure for Peterson Ave. Bridge, in Cook Co., to M. J. McDermott & Co., 105 South Dearborn St., Chicago, $31,529***subway structure in Iroquois Co., to T. McQueen, Forest Park, $51,012*** substructure for Peterson Ave. Bridge, in Cook Co., to E. J. Albrecht Co., 2632 West 26th St., Chicago, $30,776. Grand total $166,275. P.W.A. Bids Mar. 3, Apr. 3, 13 and 18, awarded in May. Noted Mar. 22 and Apr. 26.

Illinois—Dpt. P. Wks. & Buildings, Div. Hys., Springfield, subway structure near Melrose Park, Cook Co., to E. J. Albrecht, 2632 West 26th St., Chicago, $141,817. P.W.A. Bids May 29, awarded June 18. Noted May 24.

Ill., Chicago—Cook Co., County Bldg., constructing 1st Ave. bridge, to E. P. Evans Co., 1444 Bryan Pl., $16,012***Caldwell Ave. bridge, to M. J. McDermott & Co., 105 South Dearborn St., $34,889***culvert on Hibbard-Willard Rd. and Lawrence Ave. Culvert, to Van Etten Bros. Builders, Inc., 11024 South Michigan Ave., $3,875 and $3,625 respectively. Grand total $58,401. P.W.A. Bids June 5. Noted June 4 Daily.

Iowa—State Hy. Dpt., Ames, concrete box culvert, Cass Co., to P. O. Akin, Corning, $3,620***17 pipe culverts, Iowa Co., to M. O. Burnett, Marengo, $2,375***10 box culverts, Iowa Co., to Griffis Bros. Constr. Co., Valley Junction, $4,980***bridge, Jasper Co., to A. Melburg, Cedar Rapids, $15,864***56 pipe culverts, Keokuk and Washington Counties, to F. O. Montgomery, Sac City, $7,448***33 box culverts on same road, to Kelley Constr. Co., Des Moines, $15,439***bridge in Webster Co., to Des Moines Asphalt Paving Co., 2nd and New York Sts., Des Moines, $87,973. Grand total $393,366. P.W.A. Bids June 5, awarded June 19. Noted May 31.

Iowa—State Hy. Comn., Ames, bridge in Allamakee and Clayton Counties, to T. Fisko, Garber, $4,525***1 box culvert, Audubon Co., to J. Grose, Prairie City, $784***2 bridges in Shelby, Harrison and Pottawattamie Counies, to E. A. Kramme Co., Des Moines, $30,375*** five bridges on same road, to C. Ray Yegge, Boone, $24,884. Grand total $60,550. Bids June 20. Noted June 14.

Maryland — State Roads Comn., Baltimore, bridge consisting of two 63½ ft. steel girder spans over Winters Run on Philadelphia Rd. Relocation, Contr. H-184-3-48, P.W.A., Hartford Co., to Interstate Eng. Co., Hearst Tower Bldg., Baltimore, $45,400. Bids June 12. P.W.A. Noted May 31.

Mississippi and Alabama—See "Unclassified."

Miss., Vicksburg—H. E. Bovay, receiver and K. D. Wells, co-receiver for Vicksburg Bridge & Terminal Co., Court Room of Judge B. C. Dawkins, U. S. Dist. Court, Alexandria, La., replacing present wooden trestle approach on Louisiana side of Mississippi River south of here with steel deck plate girders span, single track for railroad, 20 ft. roadway, to Missouri Valley Bridge Co., Leavenworth, Kan., $229,000. Bids June 7. Noted Feb. 8.

New York—See "Streets and Roads."

N. Y., Buffalo—See "Proposed Work."

N. Y., Champlain—See "Proposed Work."

N. Y., Hamburg—Erie R.R. Co., G. S. Fanning, ch. engr., Midland Bldg., Cleveland, O., furnishing, delivering structural steel and castings, pins and rockers for eliminating Big Tree Rd. Crossing on Buffalo-Hamburg Co. Rd., to American Bridge Co., 71 Bway., New York, $18,800. Noted Feb. 5, 1931.

O., Columbus—W. J. Lucks, dir. Service, 273 ft. rein.-con. bridge consisting of 118 ft. arch span and approaches, 2 seven ft. sidewalks, 30 ft. roadway on Calumet Ave., to C. C. Dodd, Spencer, W. Va., $44,699. P.W.A. Bids June 7. Noted Mar. 15.

Washington—State Hy. Comn., Olympia, 208 ft. bridge in Snohomish Co., to Neukirch & Munter, 412 East John St., Seattle, $25,984. P.W.A. Bids May 15, awarded June 12.

Washington—State Hy. Dpt., Olympia, constructing bridges over Deception and Canoe Passes linking Whidby Island to the mainland near Anacortes, Skagit and Island Counties, to Puget Sound Constr. Co., Colman Bldg., Seattle, $304,755. P.W.A. Bids June 19. Noted June 7.

†*Federal Government.*

Wash., Wenatchee — Comrs. Chelan Co., 3 steel, timber bridges, channel and road repair work incl. 9,200 cu.yd. Class A, 5,300 cu.yd. solid rock, and 18,800 cu.yd. channel excav., 6,680 cu.yd. crushed stone in Mission Creek District, to Bjork Bros. & Lind, 2437 West 63rd St., Seattle, $37,445. Bids June 5. Noted June 7.

Wis., Milwaukee — Chicago, Milwaukee, St. Paul & Pacific R.R. Co., C. F. Loweth, ch. engr., Union Sta., Chicago, Ill., rein.-con. grade separation on Brow St. between North 30th and 31st Sts., to Selger-Ornst Co., 6222 West State St., Wauwatosa. Bids June 8.

STREETS AND ROADS

BIDS ASKED

California—State Hy. Comn., Sacramento, temporarily withdrew bids to have been opened July 5 for grading 1.1 mi. hy. between point 4 mi. east of Half Moon Bay and Summit, San Mateo Co. C. H. Purcell, P. Wks. Bldg., Sacramento, engr. Noted June 21.

Calif., Fairfax — July 20, by L. A. Grosbauer, town clk., improving Tamalpais Rd., etc., involving 15,410 cu.yd. grading, 10,380 lin.ft. curbing and guttering, 194,022 sq.ft. paving, and 10- to 48-in. culverts, catch basins, sanitary sewers, etc. Est. $30,500.

†Colorado—P. Bds., Denver, rejected bids May 28, surfacing 21 mi. Berthoud Pass and 2 mi. Fall River Rd., Rocky Mountain Natl. Park. Will readvertise.

Ia., Council Bluffs—July 3, by Pottawattamie Co., grading 3.36 mi. County Trunk Rd. J. from junction of U. S. Rd. 30 northeast, incl. 103,000 cu.yd. excav. P. V. Saum, co. engr.

Ia., Elkader — July 5, by Clayton Co., crushed limestone in stockpiles on 10.98 mi. road from Primary Rd. 128 south towards Garber, Project 5-RL; 1.72 mi. County Trunk Project 5-R, Rd. C. from Garber northeast; 5.99 mi. Project 13-RL, from U. S. 18 south and west to County Trunk Rd. P. D. E. Hoover, co. engr.

Ia., Guthrie Center—July 6, by Guthrie Co., grading 6.1 mi. secondary road, incl. 50,000 cu.yd. excav. L. S. Gates, co. engr.

Ia., Muscatine—July 6, by Muscatine Co., grading 16.82 mi. on secondary road, incl. 70,655 cu.yd. Class 2a and 50,162 cu.yd. Class 3 excav.; also delivering 644 lin. ft. 18- to 36-in. culvert pipe, 52 connecting bands for same at county yard. F. P. Halbfass, co engr.

Kentucky—July 12, by State Hy. Comn., Frankfort, grading, draining 4 mi. Jackson-Salyersville Rd., Breathitt Co., (flood relief project); 0.1 mi. Manchester-McKee Rd., Clay Co. (state project); 6.1 mi. Mt. Carmel-Tollesboro Rd., Fleming and Lewis Counties (state project); 2.4 mi. Foxport-Mt. Carmel Rd., Fleming Co. (state project); 3.1 mi. Dukedom-Pilot Oak Rd., Graves Co., (state project 9); 4 mi. West Liberty-Sandy Hook Rd., Morgan Co. (flood relief); 3.8 mi. Bremen-Millport Rd., S. P. 128, Muhlenberg Co.; 4.9 mi. Sullivan-Boxville Rd., Union Co., (state project); low type surfacing 3 mi. Mannsville-Bradfordsville Rd., S. P. 743, Taylor Co.; 10.7 mi. Bardstown-Elizabethtown Rd., S. P. 94CG, Nelson Co.; overhead bridge at Stearns Coal and Lumber Co. tracks, McCreary Co. (state project); 150 ft. steel span for bridge over Big Goose Creek, on Manchester-Hyden Rd., Clay Co. (state project).

Maryland—July 3, by State Roads Comn., Baltimore, grading, drainage for dual hy. along Phila. Rd. relocation from Baltimore City line to point 1 mi. east of Golden Ring Rd., on 4.19 mi. Contr. B316-48, Federal Aid Project N.R.H. 235A, Baltimore Co.

Mississippi—July 3, by E. D. Kenna, dir. State Hy. Comn., Jackson, grading, drainage structures, concrete paving 7.726 mi. underpass on Tupelo-New Albany Hy., N.R.H. 122, N.R.M. 122 and N.R.H. 169-B and N.R.M. M 169-B, Lee, Pontotoc and Union Counties involving 170,447 cu.yd. common earth excav. $140,000.

Missouri—July 6, by State Hy. Dpt., Jefferson City, crushed stone surfacing 2.44 mi. Route SB, Bynumville-Weir Rd., Chariton Co.; 4.734 mi. Route SJ, Avalon-Bedford Rd., Livingston Co.; 4.1 mi. Route SJ, Jacksonville East Rd., Randolph Co.; graveling 0.796 mi. Route SH, Route 4 South, Putnam Co.; 3.834 mi. road from Hannibal North, Route SB, Marion Co.; 3.772 mi. Route SB Perry South, Ralls Co.; 2.521 mi. Route SN, Hodge-Route 24, 1.48 mi. Route SP, Dover Station to Route 24, both Lafayette Co.; 3.429 mi. Route SE, Richmond-Camden Rd., Ray Co.; 3.908 mi. Route SD, 5.948 mi. Route SH, Stover Rd. So., both Morgan Co.; 0.366 mi. Route 19, Steelville S., Crawford Co.; 5.802 mi. Bonne Terre-Old Mines Rd., Route SJ, St. Francois Co.; 8.521 mi. Route SK, Bonne Terre-Old Mines Rd., Washington Co.; 4.578 mi. Waynesville S. Rd., Route H, Pulaski Co.; 5.74 mi. Joy-Darien Rd., Route SE; 5.246 mi. Route SK, Darien-Route 19 Rd., both Dent Co.; 3.087 mi. Centerville-Black Rd., Route SA; 1.621 mi. Route ST, Edge Hill-Iron Co. Rd., both Reynolds Co.; 2.996 mi. Barrtlett-Alley Springs Rd., 3.685 mi. Route SM, Moritier-Jacks Forks Rd., both Shannon Co.; 3.02 mi. Route SC, Storr-Route 51; 2.288 mi. Route Sp, Route 51-Route C, both Bollinger Co.; 4.568 mi. Route 51-Route C, Route SP, Wayne Co.; 2.264 mi. Kinzer-Colvin Rd., Route ST, Butler Co.; 4.117 mi. Semnoth Rd., North Route SA, Dunklin Co.; 4.978 mi. Route SB, Risco-Route T Rd.; 0.514 mi. Route ST, Risco-Gideon Rd., both New Madrid Co.; 3.013 mi. Route SA Chaffee-New Hamburg Rd., Scott Co.; grading 3.881 mi. Route 19-Rhineland, Route SM, Montgomery Co.; grading, graveling, bridging 1.545 mi. Route 27, • Dix Rd. S., Pulaski Co.; surface stabilization 3.026 mi. Glencoe-Eureka Rd., Route SB, St. Louis Co.; bituminous mat surfacing 12.556 mi. Route 6, Kirksville-Edina Rd., Adair Co.; 0.648 mi. Route 6, Kirksville-Edina Rd., Knox Co.; 11.431 mi. Route 5, Versailles South, Morgan Co.; 10.015 mi. Rout: 25, Jackson-Morley Rd., Cape Girardeau Co., 1.426 mi. Route 55, same road; 12.068 mi. Route 55AP1, Jackson-Morley Rd., Scott Co.; bituminous surface treating 10.6 mi. Route 25, Bloomsdale-St. Genevieve Rd., Ste. Genevieve Co.; asphaltic cement paving 4.002 mi. Weber Rd.-Route 77, St. Louis Co.; oil graveling on 0.572 mi. Route SV, Maywood, Marion Co.; 0.507 mi. Route SV, Maywood-Route 6, Lewis Co.

New Jersey—July 9, by State Hy. Comn., Trenton, grading, concrete paving 4 mi. Route 25, Sect. 12, Bridgeboro to Cinnaminson Rd., Burlington Co., incl. 72,012 cu.yd. unclass. excav. A. L. Grover, ch. clk.

N. Y., Brooklyn—July 5, by R. V. Ingersoll, pres. Brooklyn Boro, grading, curbing, flagging Avenue Z; asphalt paving Empire Blvd., Lincoln Pl., East 19th and Penn Sts., Coney Island and Stone Aves.

N. Y., Long Island City—July 2, by G. U. Harvey, pres. Queens Boro, Queens Subway Bldg., grading, asphalt on concrete paving Regina Blvd., Twombly Rd., Clinton, 37th, Dickens, 23rd and Franconia Aves., 32nd, 62nd, Olcott, Dartmouth, 65th, 82nd, Harrow, 64th and 21st Sts.

N. Y., New York—July 2, by S. Levy, pres. Manhattan Boro, Municipal Bldg., sheet asphalt on concrete repaving West End Ave. and Rutherford Pl., granite block repaving Lafayette St.

N. Y., New York—July 6, by S. Levy, pres. Manhattan Boro, Boro Hall, asphaltic block repaving West 130th St.; granite block paving West 18th and Prince Sts.; sheet asphalt on 6 in. concrete repaving West 81st, East 136th, West 68th, West 90th and East 131st Sts.

N. Y., West Haverstraw—July 17, by Commissioner Dpt. Health, State Office Bldg., Albany, constructing roads and walks at New York Reconstruction Home.

Oklahoma—July 10, by State Hy. Dpt., Oklahoma City, grading, draining 1.98 mi. country road near Wapanucka, Coal Co., 36 ft. $22,000. C. L. Wilson, state hy. engr.

Pa., Warren—See "Contracts Awarded."

Washington—July 10, by State Hy. Comn., Olympia, bituminous surfacing 9.4 mi. Inland Empire Hy., and 8.5 mi. Idaho Line-Colton Hy., Whitman Co.; paving 9.6 mi. State Rd. 9, Clallam Co.; grading 9 mi. and surfacing 14.7 mi. State Rd. 13, Grays Harbor and Pacific Counties; constructing undercrossing of Great Northern R.R. and bridge over Nason Creek, on Rd. 15, near Berne, Chelan Co.

Wash., Prosser—July 6, by Comrs., Benton Co., oiling, bituminous treating 30 mi. Hanford-Richland Rd., Prosser-Walnut et al. $43,279. H. J. Strandwold, Prosser, co. engr.

Wash., Walla Walla — Comrs. Walla Walla Co., rejected bids June 18, improving Secondary Rd. 3. Noted June 7.

Ont., Fort William—City soon takes bids, asphalt paving City Rd., $65,000; paving Norah St., $20,000 (under consideration). C. B. Symes, city engr.

Ont., Port Arthur—See "Contracts Awarded."

CONTRACTS AWARDED

†Ala., Montgomery—Con. Q.M., Maxwell Field, roads, parking area, paved aprons, sidewalks and storm sewers at Maxwell Field, to A. Blair, First Natl. Bank Bldg., Montgomery, $32,282. Bids June 4. Noted May 31.

Arkansas — State Hy. Comn., Little Rock, grading, drainage structures, 95 ft. I-beam bridge, gravel surfacing 3.7 mi. Route 4, Sect. 4, Howard Co., to R. J. Lynch Constr. Co., Rector Bldg., 3rd and Spring Sts., Little Rock, $31,194 est. $40,000*** 2 mi. Route 71, Sect. 9, Polk Co., to Ellis & Lewis, Inc., Muskogee, Okla., $62,160 est. $80,000***grading, drainage structures, gravel surfacing, 1.75 mi. Route 67, Sect. 16, grading, drainage structures, concrete paving Jackson Co., to Rouse Constr. Co., Cape Girardeau, Mo., $52,129 est. $80,000*** 3 mi. Route 71, Sect. 10, Polk Co., to E. B. Mooney, Hot Springs, $39,392 est. $40,000***1.5 mi. Route 43, Sect. 1, Newton Co., to T. Eads, Fayetteville, $18,802 est. $20,000***1 open spandrel arch bridge, having 60 ft. arch span, three 25 ft. rein.-con. deck girder spans, over Marr's Creek, Randolph Co., to Luten Bridge Co., National Standard Bldg., Little Rock, $12,652 est. $20,000. Grand total $216,330.

Arkansas—State Hy. Comn., Little Rock, grading, minor drainage structures, concrete paving 0.5 mi. Route 82, Sect. 6, Union Co., to Hartman-Clark Bros. Co., Peoria, Ill., $15,547 est. $20,000***grading, drainage structures, gravel surfacing and one I-beam bridge,

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Streets and Roads (Continued)

on 4 mi. Route 71, Sects. 8 and 9, Polk Co., to A. C. Kennedy, Poyen, $56,330, est. $60,000*** grading, drainage structures, concrete paving 0.5 mi. Route 62, Sect. 3, Carroll Co., to Consolidated Constr. Co., Tulsa, Okla., $26,878. Grand total $98,755. **P.W.A.** Bids June 20.

California—State Hy. Comn., Los Angeles, grading 5.6 mi. hy. between Escondido and Lake Hodges Dam, San Diego Co., to R. E. Campbell, 711 Central Bldg., Los Angeles, $105,296. Bids June 7, awarded June 18. Noted May 24.

California — State Hy. Comn., Sacramento, grading, selected material surfacing portions hy. between Mustang Ridge and Priest Valley, Monterey Co., to Peninsula Paving Co., Standard Oil Bldg., San Francisco, $108,515. Bids June 13, awarded June 18. Noted May 31.

†Idaho—State Hy. Comn., Boise, resurfacing 18.147 mi. Bear Lake Hy. and 5.396 mi. Grance-Preston Hy., to J. C. Compton Co., McMinnville, Ore., $45,967. **P.W.A.** Bids June 12.

†Idaho—Pub. Rds., Dpt. Agriculture, Ogden, Utah, grading, draining, crusher run material 6.747 mi. Bonner Co., to Clifton & Applegate, Hutton Bldg., Spokane, Wash., $87,878. Est. $101,087. Bids June 1. Noted May 24.

Illinois—State Dpt. P. Wks. & Bldgs., Div. Hys., Springfield, paving 1.22 mi. Cook Co., to W. J. Sheppard, 1412 Algeld St., Chicago, $116,643; subway structure in Cook Co., to E. J. Albrecht Co., 2632 West 26th St., Chicago, $141,817. Bids May 29. Noted May 24.

Illinois—Dpt. P. Wks. & Bldgs., Div. Hys., Springfield, concrete paving 6.38 mi. Clinton Co., 18 ft. to Madison Constr. Co., Edwardsville, $227,668; 6.37 mi. Clinton Co., 18 ft., to F. C. Feutz, Paris, $166,023. Bids Apr. 3, awarded in May.

Illinois—Dpt. P. Wks. & Buildings, div. Hys., Springfield, concrete paving 1.2408 mi. road in Cook Co., to J. M. Pierson, Chicago Heights, $51,928***1.3229 mi. road in Cook Co., to States Impvt. Co., 160 North LaSalle St., Chicago, $46,180***0.4091 mi. Logan Co., to G. Hoffman Constr. Co., Lincoln, $35,237*** traffic bound surface course paving 2.2285 mi. road near Rockville and 2.0038 mi. road near Essex, both Kankakee Co., to Airey Constr. Co., Oak Park, $15,510 and $12,485 respectively***1.28 mi. in Wayne Co., to J. R. Crews, Fairfield, $4,964***concrete sidewalks on 0.4786 mi. road in Cook Co., to Milburn Bros., Inc., Mount Prospect, $3,299***bridge on 0.3125 mi. Sangamon Co., to Hurden Constr. Co., Springfield, $14,998***bridges in Macon Co., to Christy Birt Co., Decatur, $4,377*** Cook Co., to Chicago Heights Coal Co., Chicago Heights, $48,331***constructing railroad crossing in Cook Co., to Chicago & Northwestern R.R. Co., 400 West Madison St., Chicago, $6,540. Grand total $243,849. **P.W.A.** Bids Feb. 27. Noted Feb. 22.

Ill., Chicago—Dpt. P. Wks. & Bldgs., Div. Hys., concrete paving 0.2168 mi. road in Cook Co., to Municipal Paving Co., 1006 North Blvd., Oak Park, $17,869; ramps for pedestrian underpass, to O. Scully Co., 7658 South Laflin St., $5,674.

Ill., Chicago—Dpt. P. Wks., City Hall, concrete paving extension of South Indianapolis Ave., to Union Contg. & Engr. Co., 8444 North Rush St., $38,506. Bids June 6, awarded June 21.

Ill., Chicago—Bd. Comrs. Cook Co., County Bldg., to Arcole Constr. Co., Niles Center, concrete paving 6,713 ft. Canal St. $135,392; 5,251 ft. California Ave. $68,009; 2,887 mi. California Ave. $53,648; 5,254 ft. 26th St.-Central Ave. Rd. $58,989; 3,229 ft. Avenue L, $40,568***to Municipal Paving Co., 1006 North Boulevard, Oak Park, 2,939 ft. Irving Park Blvd., $45,951; 1,802 ft. 76th St. $28,833; 1,620 lin.ft. 76th St. $18,911; 1,370 ft. 26th St. $16,827***to Krenn & Dato Contg. Co., 228 North LaSalle St., Caldwell Ave. $95,365; 5,765 ft. Lake Ave. $23,055***to Stanley Jaicks, Winfield, 2,657 ft. 5th Ave. $31,778; 9,274 ft. Crawford Ave. $42,789***to Jaicks Bros., 400 West Madison St., 7,026 ft. Grand Ave. $32,617; 6,680 ft. 1st Ave. $33,353; 7,815 ft. Central Ave. $127,022***to C. H. Somerville & Co., P. O. Box 429, Harvey, 5,260 lin.ft. Torrence Ave. $83,620; 1,311 ft. 3rd St. $8,499***to Aldrich Constr. Co., 111 West Washington St., 26th St. $58,772***to Bates Constr. Co., 4703 Arthington St., 5,319 ft. 1st Ave. $72,171***to A. Ward & Sons Co., Oak Glen, 8,008 ft. Torrence Ave. $22,332*** to G. D. Handin, 3139 Indiana Ave., 900 ft. Chicago-Elgin Rd. $2,906***to Davidson & Doctor, Orland Park, guttering Cottage Grove Rd., Harlem and Crawford Aves., $6,541***to L. Scully, 82 West Washington St., storm sewer in Oakton St. Drainage $746; culvert and sewering present field tile on Barrington Rd. Drainage $1,634. Grand total $1,116,995.

Ill., Chicago and Niles Center—Cook Co., Chicago, grading, concrete paving 4,684 ft. Lincoln Ave. to Midwest Constr. Co., 231 South LaSalle St., Chicago, $31,159. Rejected bids May 22, concrete paving 6,680 ft. 1st Ave., Leyden Twp., 7,044 ft. Grand Ave. and 7,815 ft. Central Ave. Bids May 22. Noted May 17. under "Niles Center."

Ill., Hillsboro—Dpt. P. Wks. & Bldgs., Div. Hys., traffic bound surface course on 3.1337 mi. road near Chapman, Montgomery Co., to Mautz & Oren, Effingham, $23,869. Bids May 24.

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†Ill., Rock Island—U. S. Eng., concrete driveway, curbing, draining, in esplanade Lock 15, Mississippi River, to W. D. Phelan & Co., Lane Bldg., Davenport, Ia., $1,810.

Indiana—State Hy. Comn., Indianapolis, grading, structures, crushed stone surfacing 6.750 cu.yd. in Spencer Co., to J. Hoffman, 2626 North James St., Indianapolis, $53,709. Est. $64,358. Bids June 12. Noted June 7.

Iowa—State Dpt. Hys., Ames, concrete paving 13,711 sq.yd. Cass Co., to E. W. Wickham & Co., Council Bluffs, $33,677***grading 4.606 mi. Iowa Co., to G. H. Lowe, Cedar Rapids, $12,924***13.585 mi. Keokuk and Washington Counties, to Griffis Bros. Constr. Co., Valley Junction, $38,247***bituminous surfacing 1.533 mi. N.R.S. 387 and 5.522 mi. N.R.S. 388, Grundy Co., to Koss Constr. Co., 205 Old Colony Bldg., Des Moines, $7,916 and $27,117 respectively***5.141 mi. N.R.S. 390 and 9.75 mi. N.R.S. 474, Marion Co., to J. S. McLaughlin Sons Co., 300 Liberty Blvd., Des Moines, $23,075 and $48,946 respectively***5.597 mi. N.R.S. 449, and 2.227 mi. N.R.S. 454, Mitchell Co., to Kelley Constr. Co., Des Moines, $21,357 and $8.149 respectively***5.856 mi. Pottawattamie Co., to Yant Constr. Co., 1115 Omaha Natl. Bank Bldg., Omaha, Neb., $34,259. Grand total $255,667. P.W.A. Bids June 5, awarded June 19. Noted May 31.

†Ky., Fort Knox—Con. Q.M., concrete sidewalks, to Andrews Collins Asphalt Co., 13th and St. Louis Sts., Louisville, $20,750. Bids May 29. Noted May 24.

Maryland—State Roads Comn., Baltimore, grading, drainage for dual hy. along Phila. Rd. relocation from Little Gunpowder Falls to Ha Ha Swamp, 4.93 Mi. Contr. H-184-48, Harford Co., to N. L. Teer, Durham, N. C., $127,981. Bids June 12. **P.W.A.**

Maryland—State Roads Comn., Baltimore, macadam paving 1.29 mi, Contr. W-143-1-62, Federal Aid Project N.R.S. 326-A, Washington Co., to F. J. Byron, Baltimore, $26,404. **P.W.A.** Bids Apr. 3. Noted Mar. 29.

Massachusetts — Commonwealth of Massachusetts, Dpt. P. Wks., 100 Nashua St., Boston, F. E. Lyman, comr., bituminous macadam resurfacing and widening 26,907 ft. N.R.A. Project R-34, Docket 5663, Essex and Gloucester, to Welch & Moynihan, 15 Front St., Salem, $205,699. **P.W.A.** Bids May 29, awarded June 15. Noted May 17.

Massachusetts—Town of Scituate, W. I. Lincoln, chn. Bd. Selectmen, at office of Dpt. P. Wks., Commonwealth of Massachusetts, 100 Nashua St., Boston, bituminous macadam paving 2,304 ft. State Aid Project, Scituate, to Lee Constr Co., Inc., 133 Southampton St., Boston, $22,412. Bids June 12, awarded June 15.

†Massachusetts — U. S. Eng., Boston, resurfacing gravel roads with bituminous material along Cape Cod Canal, in Bourne and Sandwich, to F. B. Lawrence, Falmouth, $2,068. Bids May 28.

Minnesota—State Hy. Dpt., St. Paul, improving 0.12 mi. State Project 71-4-44-3-A, NRM 488-B, to C. F. Scully Equipment Co., 519 Guardian Bldg., St. Paul, $33,364. **P.W.A.** Bids June 15.

Mississippi — E. D. Kenna, dir. State Hy. Comn., Jackson, grading, culverts, bridges 10 mi. Project 251, Yazoo Co., to I. L. James & Co. and Littrel Constr. Co., Ruston, La., $63,018***7 mi. Project 72-B, Holmes Co., to Chas. Weaver, Inc., Anoka, Minn., $80,323***grading, drainage 1 mi. Project 163, Rankin Co., to Ed. E. Morgan Co., Jackson, $20,394***grading, culverts, bridges 3.5 mi. Propect 249, Tippah Co., to Newsom Bros. and Hodgkins-Adams Co., Columbia, $39,470***grading, drainage, bridge over Sunflower River, 0.5 mi. Project 139 B, Coahoma Co., to Pigford Bros., Meridian, $65,198 Grand total $268,403. Bids June 19 awarded June 19. Rejected bids June 19, grading, culverts 5 mi. Project 90 C, Tunica Co., grading culverts, bridges, sand clay topping 5 mi. Project 246, Leake Co. Will readvertise. Noted June 14.

N. J., Spotswood—Council, rein.-con. paving 1.001 mi. Spotswood-Englishtown Rd. and Mundy Ave., to Utility Constr. Co., 84 Patterson St., New Brunswick, $27,760. Bids June 14.

New York—A. W. Brandt, comr. Hys., Albany, mixing method type 2 and sep. structure on 0.2 mi. Queens Co., to Clevorock, Inc., 420 Lexington Ave., New York, $149,512 est. $178,406***24 ft. span bridge, concrete box mixing method optional; approaches 0.17 mi. Madison Co., to C. T. Hookway, 811 North Alvord Ave., Syracuse, $17,681 est. $24,679 ***5.42 mi. Seneca Co., to J. Bellardino, Seneca Falls, $121,835 est. $159,218***concrete paving 1.84 mi. Suffolk Co., to Good Roads Eng. & Contg. Co., Wantagh, $157,847 est. $169,608***2.6 mi. Suffolk Co., to W. P. McDonald Constr. Co., 33-94 Lawrence St., Flushing, $307,950 est. $335,073***retreat base course surfacing 15.59 mi. in Westchester Co., to Tuckahoe Constr. Co., Inc., Tuckahoe, $165,906 est. $177,896***roads in Westchester Co., to Camarco Contractors, Inc., Ossining, $83,707 est. $87,775***bridges in Delaware Co., to Columbia Bridge Constr. Co., Ancram, $16,655 est. $19,810***furnishing, delivering plant material in Chemung Co., to Flowerdale Green House, Washington and Main Sts., Albany, $7,595. est. $8,506. Grand total $1,028,688. **P.W.A.** Bids June 1 and 15. Noted May 24.

New York—A. W. Brandt, comr. Hys., Albany, improving roads in Madison Co., to C. T. Hookway, 811 North Alvord St., Syracuse, $17,681***Delaware Co., to Columbia Bridge Constr. Co., Ancram, $16,655***Chemung Co., to Jackson & Perkins Co., Newark, $7,619*** Queens Co., to Cleverock, Inc., 420 Lexington Ave., New York, $149,512. Grand total $1,1[illegible]467. Bids June 1. Noted May 24.

O., Cincinnati—City, grading, draining, sewers, water lines, walks, rein.-con. paving 23,000 sq.yd. West Fork Rd., to Andrews Asphalt Paving Co., 808 1st Natl. Bank, Hamilton, $101,045. Est. $118,288. **P.W.A.**

O., Cincinnati—Comrs. Hamilton Co., grading, drainage, 9 in. rein.-con. paving 9,000 sq.yd. East Miami River Rd., to E. J. Knepfle Sons, 520 East Riverside Dr., Newport, Ky., $74,501. Est. $91,580. **P.W.A.** Bids June 13.

O., Cincinnati—City, grading, drainage, sewers, 7 in. rein.-con. paving 4,000 sq.yd. Lueders Ave., to S. A. Ruebel & Co., 4329 Kirby Rd., $19,782. Est. $22,000.

O., Cleveland—Cuyahoga Co., G. H. Stahler, clk., concrete curbing, guttering, concrete paving 19,552 sq.yd. and 27,423 lin.ft. sealing existing pavement on Canal Rd., to J. C. Fischer, 16118 Lorain Ave., $53,821. Est. $64,000. **P.W.A.**

O., Cleveland Heights—City, cutback asphalt paving 49 streets, involving 62,000 gal. cut back asphalt, 122,000 sq.yd. dragging, 3,100 tons slag, to Cuyahoga Asphalt & Paving Co., 9501 Woodland Ave., Cleveland. Est. $24,800. **P.W.A.**

O., Shaker Heights (br. Cleveland) — City, gravel and asphalt paving 116,000 sq.yd. 34 streets, to Cuyahoga Asphalt & Paving Co., 9501 Woodland Ave., Cleveland, $23,334. Est. $25,130. **P.W.A.**

Pennsylvania—At office S. S. Lewis, secy. Dpt. Hys., Harrisburg, rein.-con. and bit. penetration paving and rein.-con. arch bridge 0.74 mi. Route 121, Sect. 4, Route 33, Sect. R-1, Huntingdon and Mifflin Counties, to C. A. and F. M. Wagman, Dallastown, $195,431. **P.W.A.** Bids May 11. Noted June 21.

Pennsylvania—Dpt. Hys., Harrisburg, rein.-con. and bituminous surface treated macadam paving 0.44 mi. Route 4, Spur, Larksville Borough, N.R.M. 255-B, Luzerne Co., to B. G. Coon Constr. Co., 278 Union St., Luzerne, $36,842. **P.W.A.** Bids May 24. Noted May 10.

Pa., Warren — Borough Council authorized bituminous material paving 5th Ave. from Conewango Ave. to Borough limits, day labor, under supervision of Boro Engineering Division. Est. $40,000.

Rhode Island—State Bd. P. Rds., State Office Bldg., Providence, sheet asphalt on concrete paving 0.975 mi. Project N.R.M. 40C, Allens Ave., Providence, Contr. 3409, Providence Co., 52-62 ft. wide, to M. A. Gammino Constr. Co., Inc., 728 Valley St., Providence, $100,734. **P.W.A.** June 13. Noted June 7.

Rhode Island—State Metropolitan Park Comn., State Office Bldg., Providence, bituminous macadam paving 5,600 ft. Meshanticut Parkway, Cranston, to Bowerman Bros., 70 Bath St., Providence, $31,984.

South Dakota—State Hy. Comn., Pierre, to Summit Constr. Co., Summit, and Central Constr. Co., Sioux Falls, concrete paving 1.651 mi. in Hughes Co., $53,954***to Queen City Constr. Co., Sioux Falls, 0.554 mi. Davison Co., $20,902 ***to Northwestern Eng. Co., Rapid City, oiling 17 mi. Gregory Co. $18,330; 6.653 mi. Haakon Co. $7,916***to Larson Eng. Co., Sioux Falls, 17.24 mi. Lyman Co. $27,253***to Inland Constr. Co., 3867 Leavenworth St., Omaha, Neb., graveling 8.984 mi. Kingsbury Co. $15,198 ***to E. Bradley, Wagner, 5.014 mi. Jerauld Co. $5,453; 7.926 mi. Bon Homme Co. $12,170*** to W. E. Bartholow & Son Constr. Co., Huron. 6.177 mi. Spink Co. $15,411***to Chaulk & Birdsall, Lead, graveling 8.772 mi. Pennington Co. $131,382***to Sorenson & Stull, Trent, 4.291 mi. Clark Co. $13,340; 5.01 mi. Beadle Co. $19,584; 8.208 mi. Clark Co. $12,696*** to Dowd Bros., Inc., Clark, 6.233 mi. Day Co. $23,921***to Gross & Stevens, Scottsbluff, Neb., 4.426 mi. Perkins Co. $14,233; 4.797 mi. Pennington and Meade Counties $11,021***to S. E. Gustafson, Beresford, 14.621 mi. Lincoln and Union Counties $54,704***to C. A. Wagner Constr. Co., Sioux Falls, 6.196 mi. Brown Co. $13,885. Grand total $471,353. **P.W.A.** Bids June 14.

Tex., Victoria—City, B. T. Jordan, mayor, 6,997 sq.yd. 6 in. concrete paving, 1,979 cu.yd. excavating, 2,913 lin. ft. monolithic curbing, accessories, etc., West Forrest St. and others, to H. B. Zachry, Laredo, $27,680.

†Virginia—Pub. Rds., Wash., D. C., constructing 9.76 mi. Skyline Dr., from Front Royal to Comptons Gap, Shenandoah Natl. Park, to Waugh Bros., Culpeper, Va., and Fayetteville, W. Va., $427,192; 10.55 mi. same road from Comptons Gap to Hog Back Mountain, to Sammons Robertson, Inc., Huntington, W. Va., $363,893. Bids June 1. Noted May 17.

Washington—State Hy. Dpt., Olympia, bituminous macadam paving 14.76 mi. road in Mason and Grays Harbor Counties, to J. F. Forbes, Olympia, $59,403***bituminous surfacing 65.6 mi. roads in Mason, Jefferson and Kitsap Counties, to F. J. Kernan, Paloma, Ore., $45,311. Rejected bids June 5, road in Lewis and Pierce Counties.

Washington—State Hy. Dpt., Olympia, grading, crushed stone surfacing 17.315 mi. road in Grays Harbor Co., to L. J. Dowell, Inc., 1437 Elliott St. W., Seattle, $300.176. Re-

†*Federal Government.*

Streets and Roads (Continued)

jected bids June 12 bituminous surfacing 117.65 mi. road on Greys Harbor, Jefferson and Clallam Counties; 118.05 mi. Lewis, Wahkiakum and Cowlitz Counties; grading, crushed rock surfacing 7.44 mi. Grays Harbor Co.

†Wyoming—Pub. Rds., Denver, Colo., base course oiling 35.95 mi. road in Teton and Sublette Counties, to O. Nelson, Logan, Utah, $63,625. Bids June 4. Noted May 24.

Ontario—Deputy Minister Hys., Parliament Bldgs., Toronto, concrete paving 5 mi. Marpeth-Ridgetown Hy., Contr. 34-50, to Cross Suppplies & Paving Ltd., 924 Windsor Ave., Windsor•••6 mi. Ridgeway East Hy., Contr. 34-49, to Dominion Constr. Co. Ltd., 217 Bay St., Toronto•••5.3 mi. Kinless East Hy., Contr. 34-52, to Goldie Constr. Co. Ltd., 32 Church St., Toronto•••surface treating 14 mi. Dunham Residence Hy., Contr. 34-66, to A. E. Jupp Constr. Co. Ltd., 170 Berkeley St., Toronto•••22 mi. Landau Residency, Contr. 34-64, to J. Poisser, Streetsville•••45 mi. Brackville Residency, Contr. 34-65, to Henniger & Scott, Smiths Falls •••25 mi. Stratford Residency, Contr. 34-67, to C. C. Cornell, 74 Dundas St., Brantford••• Ottawa Residency, Contr. 34-68, to Bituminous Spraying & Contg. Co., 49 Givens St., Toronto •••56 mi. Port Hope Residency, Contr. 34-69, to Municipal Road Spraying & Oiling Co. Ltd., 225 Sterling Rd., Toronto•••crushing stone, Hy. No. 7, Lennax and Addington Co. Hy., Contr. 34-71, to F. Milligan, Iroquois•••same road, Contr. 34-72, to J. R. McQuigg, Arnprior •••tile drainage 8 mi. Clinton N. Hy., Contr. 34-59, to Farr & Hern, Niagara St., St. Catherines•••Hawkesbury S. Hy., to Glengarry Co., Contr. 34-60, to R. Beattie, Ironprior•••Sarnia to Wallaceburg, Contr. 34-62, to O. Beattie, 2 Papier St., Dundas.

Ont., Port Arthur—J. Antonisen, city engr., on widening, new curbing, asphalt paving, Algoma St., day labor. $40,000. **Maturity soon.**

Ont., Toronto—York Twp., H. C. Rose, twp. engr., 57 Adelaide St. E., Toronto, mixed macadam paving 7 mi. Bathurst St., Contr. 5-34., to Gibson & Van Nostrand Ltd., 375 Fleet St. W.; 1.2 mi. Woodbridge approach, Contr. 6-34, to Rayner Constr. Co. Ltd., 29 Commercial St., Leaside.

EARTHWORK, IRRIGATION DRAINAGE AND WATERWAYS

PROPOSED WORK

†Illinois—U. S. Eng., 932 Post Office Bldg., Chicago, preliminary plans and takes bids in 60 to 90 days new lock and dam for upper end Peoria Lake, Illinois Waterway, Peoria, $4,-632,000; replacing old lock with immediate completion of new lock and dam of LaGrange Lock, on Illinois Waterway, between Beardstown and Meredosia, $4,500,000; bids in 60 to 90 days widening portions of Illinois River from 200 to 300 ft. in various counties, $6,409,000.

S. C., Columbia — Governor Blackwood appointed a committee to act as State Authority to develop a navigation and power plant on Santee and Cooper Rivers between Columbia and Charleston. Application for P.W.A. funds, $34,000,000.

†Texas—Intracoastal Canal, c/o Rivers & Harbors Dpt., and Arroyo Colorado Navigation Dist., Wash., D. C., plan constructing Intracoastal Canal from Corpus Christi to Harlingen and Pt. Isabel. $4,000,000.

†Texas—Valley Conservation Dist., c/o F. S. Robertson, San Benito and Federal Rivers & Harbors Dpt., Wash., D. C., plan dam and power construction in Rio Grande River, with dams at St. Louis Valley Sect., El Paso Sect., and region from Fort Quitman to Gulf past the lower valley sections, for water supply and control of flood waters. New Surveys to be presented to the new congress. $29,000,000.

Ontario — Secretary Dpt. P. Wks., Ottawa, soon takes bids dredging Little Castor River and Annable Creek, Winchester, Carleton Co., $16,000; dredging in Spring Creek, Cornwall, Glengarry Co., $10,000. Cost to be borne by Dominion and Ontario Provincial Governments. K. M. Cameron, Ottawa, engr.

BIDS ASKED

†Conn., New Haven—July 6, by U. S. Eng., Providence, R. I., removing 344 cu.yd. rock and 90 cu.yd. material other than rock from New Haven Harbor.

†Louisiana—July 10, by U. S. Eng., Vicksburg, Miss., constructing 644,000 cu.yd. earthwork on east bank Ouachita River. $190,000.

†Mich., Pentwater—July 3, by U. S. Eng., Federal Bldg., Milwaukee, Wis., dredging 48,000 cu.yd. from entrance channel Pentwater Harbor.

†Miss., Vicksburg — July 6, by U. S. Eng., 644,000 cu.yd. levee work from Monroe to Sterlington New Levee.

†Montana—July 12, by Bureau Reclamation, Dpt. Interior, Fairfield, constructing earthwork and structures on Mill Coulee Canal, and lateral enlargements and extensions for Greenfields Div., Sun River Project, near Fairfield and Ashuelot, incl. 79,000 cu.yd. excav. for laterals; 3,700 cu.yd. excav. for structures, Spec. 578.

†Oregon—July 5, by Bureau Reclamation, Portland, constructing Bonneville Dam Navigation Locks, 516 ft. long, 76 ft. wide, and power house substructure, incl. concrete for intakes, 6 power units, draft tube for 2 power units, excavation and concrete for fishway and backfill at north end of power house. $3,500,000. Noted June 7, under "Contracts Awarded."

†Oregon-Idaho—July 12, by Bureau Reclamation, Ontario, Ore., constructing earthwork, tunnel and structures for Kingman Lateral and Sub-laterials KL-9.3 to KL-10.0 (inclusive), Mitchell Butte Div. Owyhee Project, incl. 282,-000 cu.yd. lateral, 9,000 cu.yd. structural and 400 cu.yd. tunnel excav.

New Brunswick—July 13, by Secretary Dpt. P. Wks., Ottawa, wharf repairs at Shippigan, involving 105,000 cu.ft. cribwork fully ballasted, 32,000 ft. B.M. creosoted sheathing, 32,000 lin. ft. creosoted and 1,200 lin. ft. untreated piles, 21,000 ft. B.M. 3 in. plank covering, 50,000 ft. B.M. square timber, 5,500 lb. iron straps, $23,000; wharf reconstruction and harbour improvements, 323 ft. pier, 17 to 25 ft. wide, St. Andrews, involving 11,000 lin. ft. piles, 200,000 ft. B.M. spruce lumber, 40,000 ft. B.M. new creosoted hardwood, 20,000 ft. B.M creosoted hardwood relaid, and 2,000 lb. iron, $25,000. K. M. Cameron, Ottawa, Ont., engr.

Ontario—July 3, by Secretary Dpt. P. Wks., Ottawa, dredging 50,400 cu.yd. clay, sand and silt, Belleville, $15,500; 21,500 cu.yd. silt, sand and clay, and 2,200 cu.yd. submarine rock excav., Oakville, $18,000. K. M. Cameron, Ottawa, engr.

Ont., Burlington—July 6, by Dpt. P. Wks., Ottawa, reconstructing South Pier Section, Burlington Channel, involving 100 cu.yd. concrete for deck, 26,000 ft. B.M., pile caps and stringers, 2,300 lb. bolts, 1,500 lb. screw bolts, 5,900 lb. steel angles, 3,900 lb. tie rods, ets. $18,000. K. M. Cameron, Ottawa.

Ont., Ottawa—July 5, by Secretary Dpt. P. Wks., Ottawa, repairing dam, Rideau Falls, involving 420 cu.yd. rein.con., 1,500 lb. iron and steel, 16,000 ft. b.m. lumber, 250 lin. ft. railing. Est. $20,000. K. M. Cameron, Ottawa, engr.

Que., Rimouski—July 6, by Secretary Dpt. P. Wks., Ottawa, 100 ft. wharf extension, 32½ ft wide. K. M. Cameron, Ottawa, Ont., engr.

CONTRACTS AWARDED

†Ariz., Yuma—Bureau Reclamation, Federal Bldg., constructing earthwork All American Canal, Boulder Canyon Project, Arizona-California-Nevada, first 30 mi. in southeastern California, Schedules 1 to 6, to W. E. Callahan, Arcade Bldg., St. Louis, Mo., and H. Gunther & J. P. Shirley, Dallas, Tex., $4,859,588; Schedule 7, rock work within limit Schedule 4, to Griffith Co., Los Angeles Ry. Bldg., Los Angeles, Calif., $226,800. Bids June 7. Noted May 17.

Calif., Los Angeles—Bd. Supervs. Flood Control Dist., 205 South Bway., E. C. Eaton, engr., constructing Verdugo Wash, Conduit, concrete, from Brand Blvd. to Pacific Ave., Glendale, to Brock & Clark, 107 North Larchmont Blvd., $21,671. Bids June 6, awarded June 18.

†Illinois—U. S. Eng., Post Office Bldg., Chicago, dredging 119,500 cu.yd. from North Branch and North Branch Canal of Chicago River, to Great Lakes Dredge & Dock Co., 104 South Michigan Ave., Chicago, $63,036. Bids May 28.

†Ill., Alton—John Griffiths & Sons Co., general contractors, Builders Exch. Bldg., Chicago, splash proof electric motors for Twin Locks and Dam 26, on Mississippi River, to Century Electric Co., 1806 Pine St., St. Louis, Mo., for U. S. Eng., St. Louis, Mo. Noted Jan. 4.

Mass., Boston—Commonwealth of Massachusetts, Dpt. P. Wks., F. E. Lyman, comr., 100 Nashua St., Boston, dredging 49,000 cu.yd. Boston Inner Harbor, to Bay State Dredging & Contg. Co., 62 Condor St., East Boston, $23,-725. Bids June 12.

†Miss., Vicksburg—U. S. Eng., P. O. Box Vicksburg, constructing 77,900 cu.yd. earthwork on east bank Mississippi River, to W. F. Elkas, Landing, at 32.7c. per cu.yd. Bids June 15. Noted June 7, under "Mississippi."

†O., Fairport Harbor—U. S. Eng., Federal Bldg., Buffalo, N. Y., constructing 500 ft. extension to west breakwater with light foundation at outer end at Fairport Harbor, here, to Merritt Chapman Whitney Corp., Marion Bldg., Cleveland, (Amer. & Constr. Co.) and 17 Battery Pl., New York. $168,700. Bids June 5. Noted May 24.

†Oregon—U. S. Eng., Portland, Ore., dredging sand in Willamette River channel 10 mi. south of Portland, to Oregon City Sand & Gravel Co., Oregon City, $9,934. Est. $9,555. Bids June 13.

†Wis., Green Bay—U. S. Eng., Milwaukee, Wis., dredging 1,498,000 cu.yd. from outer channel at Green Bay Harbor, to Price Bros. Co., East Monument Ave., Dayton O., and R. P. Emerick, Sault Ste Marie, Mich., $404,460. Bids June 1. Noted May 17.

UNCLASSIFIED

PROPOSED WORK

Ark., Hartman—COAL TIPPLE—D. McGraw, Clarksville, plans coal tipple and handling plant. $30,000.

Calif., Alameda—SWIMMING POOL—Alameda High School Dist. plans by C. Werner, 1303 Bay St., swimming pool extensions, $25,000.

Mass., Dorchester—BEACH IMPROVEMENT—Commonwealth of Massachusetts, Metropolitan Dist. Comn., Park Div., D. B. Keniston, comr., 20 Somerset St., Boston, plans improving Malibou Beach, involving sanding of beach, constructing bath house, etc. $50,000.

N. Y., Syracuse—COAL POCKET—M. J. Vincent Coal Co., 115 East Genesee St., will award contract early in July from bids submitted by selected contractors for coal pocket. $50,000. Noted May 10.

N. C., Newbern—LIGHTING SYSTEM—City Council voted to extend city electric lines first to Tuscarora and then to Fort Barnwell and Lanes Chapel, will be more than 10 mi. extension. L. Scott, mayor.

Miss., Canton—GAS PIPE LINE, etc.—Municipality voted $160,000 bonds to be purchased by P.W.A. for gas pipe line and distribution system, also to acquire gas properties. To exceed $30,000. Noted Nov. 2.

N. Y., Brooklyn—RETAINING WALL, etc.—Dpt. Parks, Arsenal Bldg., Central Park, New York, plans by A. Embury, c/o owner, retaining wall and recreation building, Eastern Parkway and Washington Ave. Est. about $25,000. **Maturity in July.**

N. Y., Flushing — STABLE, etc. — Sheffield Farms, 524 West 57th St., plans by Stohldener & Zetzsche, White Plains, stable and wagon room, Flushing Ave. and Sophie St. $35,000.

BIDS ASKED

Arizona—GOLD MINING DEVELOPMENT—See "Contracts Awarded."

Pa., Saxonburg—OIL and GAS PROPERTY DEVELOPMENTS—See "Contracts Awarded."

Miss., Gulfport—PIERS and WAREHOUSE—Aug. 1, Gulfport Dock Bd., steamship piers and warehouses, incl. 1,800 ft. concrete dock, and 196 ft. wide, supported by 3,000 concrete and composite piling of a length to be determined upon completion of tests now being made under separate contract. A steel framed warehouse 1,800 ft. long, 122 ft. wide with 44 ft. wide apron on shipside to carry 3 marginal tracks is provided for, on the reverse side, a 30 ft. apron will be provided for trucks. Shourds & Bean, Gulfport, preparing plans and specifications with Shaw & Woleban, Gulfport, as consultants. Noted Jan. 18.

†N. Y., Albany—RADIO RANGE BUILDING, etc.—July 2, at U. S. Airways Radio Station, Albany, erecting type G tile and glass block radio range building and modified adcock antenna system, near here.

N. Y., Brooklyn—BATH HOUSE—M. Goldberg, Boardwalk and West 23rd St., taking bids on general and separate contracts 3 story, bath house, Boardwalk and West 23rd St. M. Marlo, 200 Beverly Rd., archt.

N. Y., New York—PIER SHEDS—July 5, by Dpt. Docks, Pier A, North River, constructing 1 or more pier sheds for Piers 88, 90 and 92, West 48th, 50th and 52nd Sts., North River. Noted June 7.

N. Y., New York—SUBSTATION—July 13, by Bd. Transportation, J. H. Delaney, chn., 250 Hudson St., constructing Stanton Sub-station, for part of Rapid Transit R.R. at Essex St., between Stanton and Houston Sts.

Tex., San Benito—AIRPORT—Vermilya & Huffman, Cincinnati, O., and San Benito, taking bids airport, consisting of 3 or 4 medium sized steel hangars, general repair shops with equipment, housing for personnel, etc. Address owners.

B. C., Barkerville—GOLD MINING PROPERTY DEVELOPMENT—See "Contracts Awarded."

CONTRACTS AWARDED

†Ala., Montgomery—ELECTRIC DISTRIBUTION SYSTEM—Con. Q.M., Maxwell Field, extending electrical distribution and street lighting system, to Sullivan & Phillips, 117 Decatur St., New Orleans, La., $6,378.

Arizona—GOLD MINING DEVELOPMENT—Union Gold Mines Co., G. Snyder, 824 North Ramport Blvd., Los Angeles, Calif., gold mining development at various locations, day labor. Will purchase materials and equipment. To exceed $40,000.

Calif., Modesto—SWIMMING POOLS—W. Tilson, Magnolia St., 35x70 ft. concrete swimming pool with filter system, to H. Brown, Laurel St. Awarded June 12. Noted May 3.

†Calif., San Francisco—PIERS—Con. Q.M., repairing fender piling and concrete piers and docks Piers 1, 2 and 3, at Fort Mason, to Healey Tibbitts Constr. Co., 64 Pine St., $28,-792 ($28,792 fender piling; $9,660 concrete patching).

†Me., Thomaston—REBUILDING BEACON—Superinterdent Lighthouses, 156 Federal St., Portland, rebuilding St. Georges Beacon, in St. Georges River, to Snow Eng. Co., Rockland, $4,469 (45 days). Bids June 21.

Mississippi and Alabama—RAILWAY—Meridian & Bigbee River Ry. Co., E. D. Sloan, chn.

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†Federal Government.

Unclassified (Continued)

engr., 23d Ave. and 4th St., Meridian, Miss., constructing and completing 21 mi. railroad from Meridian, Miss., to Myrtlewood, Ala., involving grading, drainage, bridges, trestles, furnishing all materials required in above, in construction 20 mi. roadway and bridges, incl. steel bridges over Tom Bigbee River at Myrtlewood, Ala., to MacDougald Constr. Co., Hamphill Ave., N.W., Atlanta, Ga., $750,000. Noted Apr. 13.

†**Mo., Kansas City**—PONTOON WALKWAYS—U. S. Eng., metal parts for pontoon walkways for Fort Peck Dredge units, to Omaha Steel Wks., 609 South 48th St., Omaha, Neb., $7,250. Bids May 17. Noted May 10.

†**N. Y., Cape Vincent** — FOUNDATIONS — Superintendent Lighthouses, 243 Washington St., Buffalo, foundations for East Charity Shoal Lighthouse, near here, Lake Ontario, to L. A. Wells Co., 1121 Schofield Bldg., Cleveland, O., $64,000. Bids June 5, awarded June 15. Noted May 31.

†**N. Y., Iona Island** — WHARF — Yards & Docks, Navy Dpt., Wash., D. C., repairing main wharf at Naval Ammunition Depot, Spec. 7690, to Langschur Roofing Co., Thiells, $10,000 (120 days).

†**N. C., Fort Bragg**—BALLOON HANGAR—Con. Q.M., Pope Field, 1 balloon hangar at Pope Field, to J. A. Jones Constr. Co., Charlotte, $19,500. Bids June 14.

†**Ore., Portland** — RAILROAD — U. S. Eng., relocating and reconstructing portion Spokane Portland & Seattle Ry's. track near Bonneville Dam, to P. L. Crooks & Co., Inc., Henry Bldg., $339,395. Bids June 1. Noted May 31.

Pa., Saxonburg—OIL and GAS PROPERTY DEVELOPMENTS—Perry Oil & Gas Corp., c/o W. I. Gettman, Zelienople, developing oil and gas properties, vicinity of here, day labor. To exceed $30,000.

Utah, Salt Lake City—BROADCASTING STATION—K. S. L. Broadcasting Station, remodeling broadcasting station, to Jacobsen Constr. Co., 724 South 3rd St. E., $22,000. Bids June 11.

†**Wyo., Cheyenne**—IRON and WIRE FENCING, etc.—Vet. Bu., Wash., D. C., iron and wire fencing and gates for Veterans Hospital, to Cyclone Fence Co., Waukegan, Ill., $3,630. Bids May 22.

B. C., Barkerville—GOLD MINING PROPERTY DEVELOPMENT—Cariboo King Gold, Inc., c/o J. Arthur Hurley, pres., 1215 Seneca St., Seattle, Wash., U. S. A., developing gold mining property, Cow Mountain, vicinity of here, day labor, and will purchase equipment and material. To exceed $40,000.

†**C. Z., Summit**—RADIO FOUNDATIONS—P. Wks. Officer, 15th Naval Dist., radio foundations for radio towers, Spec. 7518, to H. B. Nelson Constr. Co., 305 Red Rock Bldg., Atlanta, Ga., $7,816. Bids June 6. Noted May 31.

†**T. H., Lauluale**—RADIO TOWER FOUNDATIONS—Yards & Docks, Navy Dpt., Wash., D. C., radio tower foundations, Spec. 7523, to M. W. Moody, P. O. Box 291, Honolulu, $33,000 (120 days).

MATERIALS AND EQUIPMENT

PROPOSED WORK

†CABLE — **Kansas City, Mo.** — U. S. Eng., Postal Bldg., rejected bids 11,000 ft. dredge (portable) cable, for Fort Peck, Mont.

BIDS ASKED

†CASTINGS, etc.—**Alabama**—July 12, by Tennessee Valley Authority, Knoxville, Tenn., furnishing, fabricating and delivering 16 draft tube pier nose castings and steel columns for Wheeler Dam Project, on Tennessee River, near Muscle Shoals.

PUMP—**Fresno, Calif.**—H. S. Foster, city clk., taking bids deep well turbine centrifugal pumping unit to be installed in Roading Park.

STEAM SEPARATORS—**Chicago, Ill.**—July 3, by Dpt. P. Wks., 4 steam separators with top flanges delivered to Lake View Pumping Station, 742 Montrose Ave., 46,000 enameled metal street sign name plates, 1553 South Laflin St., furnishing, erecting at various locations 23,000 street sign units.

†LUMBER—**Boston, Mass.**—July 6, by Bu. Supplies & Accounts, several thousand feet lumber for Boston Navy Yard.

SCRAPER — **Hillsboro, N. D.** — July 6, by G. D. Olsen, aud. Trail Co., 1 new or used hydraulic scraper 3½ cu.yd. capacity.

†DISCHARGE PIPE, etc.—**Kansas City, Mo.**—July 16, by U. S. Eng., 240 pieces discharge pipe and 500 connecting links for Fort Peck Dredges.

HIGHWAY MATERIALS—**New York, N. Y.**—July 2, by R. Forbes, comr. Purchase, Municipal Bldg., highway materials to Dpt. Plant & Structures, Water Supply, Gas & Electricity, and Bronx, Brooklyn and Manhattan Boros.

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†PIPE LINE DREDGES—**Memphis, Tenn.**—July 6, by U. S. Eng., lease of 1 or 2 fully equipped pipe line dredges from 60 to 120 days for work on Lower White River, Ark.

HOSPITAL MATERIALS, MACHINERY, etc. — **Oka, Que.** — See "Commercial Buildings, under Contracts Awarded."

†CRANE—**Pearl Harbor, T. H.**—Aug. 15, by Yards & Docks, Navy Dpt., Wash., D. C., hammerhead crane. Noted June 21.

CONTRACTS AWARDED

†DREDGE LADDER, etc.—**Jacksonville, Fla.**—U. S. Eng., 1 dredge ladder and space parts for dredge "Welatka," to Abel-Davis-Receiver for Pettibone-Mulliken Co., 4710 West Division St., Chicago, Ill., $43,865; 1 turbo-generator set and equipment, to Elliott Co., Frick Bldg., Pittsburgh, Pa., $46,184. Bids May 31.

ASPHALT SAND, etc.—**Chicago, Ill.**—Dpt. P. Wks., 90,000 tons asphalt sand, to Garden City Sand & Gravel Co., 2408 Throop St., $122,400•••7,500 tons torpedo sand, to Moulding Brownell Co., 228 North LaSalle St., at $1.33 per ton, total $9,975. Bids Apr. 20, awarded June 14.

CABLE—**Chicago, Ill.**—City, 22,000 ft. 3½ in. fiber conduit for Dpt. Streets & Electricity delivered to city storeyard, 647 Blue Island Ave., to Westinghouse Electric Supply Co., 113 North May St., at 11.31c. per ft., total $2,488. Bids Apr. 9, awarded June 18. Noted May 3.

CEMENT—**Chicago, Ill.**—City, natural cement for underground work and laying of brick, to Moulding-Brownell Corp., 228 North LaSalle St., truck delivery at $2.40 per bbl. total $427,220; rail delivery at $1.935 per bbl. total $344,430. Bids May 10.

CEMENT—**Chicago, Ill.**—City, 5,000 bags mason cement for Cermack Pumping Station, to Material Service Corp., 33 North LaSalle St., at 60c. per bag, less 10c. for return of bags, total $3,000. Bids May 3, awarded June 21. Noted Apr. 26.

CEMENT—**Chicago, Ill.**—Cook Co., 45,000 bbl. portland cement, to Universal Atlas Cement Co., 208 South LaSalle St., $101,250•••20,000 bbl. to Alpha Portland Cement Co., 165 West Wacker Dr., $45,000•••55,000 bbl. to Marquette Cement Mfg. Co., 140 South Dearborn St., $123,750•••23,828 bbl., to Medusa Portland Cement Co., 228 North LaSalle St., $53,613•••20,000 bbl., to Lehigh Portland Cement Co., 111 West Washington St., $45,000. Grand total $368,613. Bids June 5, awarded June 15.

CRUSHED LIMESTONE—**Chicago, Ill.**—City, crushed limestone for Dpt. Streets & Electricity, to Moulding Brownell Corp., 228 North LaSalle St., $111,750•••crushed limestone and limestone dust, to Material Service Corp., 33 North LaSalle St., $111,750 and $40,900 respectively. Grand total $264,400. Bids Apr. 23, awarded June 14 and 18. Noted Apr. 19.

PAVING BRICK, etc. — **Chicago, Ill.** — City, 750,000 paving bricks for term ending Dec. 31, for Dpt. Streets & Electricity, to Veedersburg Paver Co., Veedersburg, Ind., $32,175•••6,000 tons limestone dust delivered at municipal asphalt plants, to Material Service Corp., 33 North LaSalle St., $20,350•••6,000 tons limestone dust, to Moulding Brownell Corp., 228 North LaSalle St., $20,350. Grand total $72,875. Bids Apr. 23, awarded June 14 and 13. Noted Apr. 19.

†PORTLAND CEMENT—**Chicago, Ill.**—U. S. Eng., 932 Post Office Bldg., 10,800 bbl. portland cement in cloth bags, to Alpha Portland Cement Co., 165 West Wacker Dr., $23,661. Bids May 31, awarded June 18.

REFINED TAR—**Chicago, Ill.**—City, furnishing, delivering, applying on streets refined tar for Dpt. Streets & Electricity, to Reilly Tar & Chemical Corp., 2500 South Robey St., $101,570. Bids May 1.

SLUICE GATES—**Chicago, Ill.**—City, four 96 in. sluice gates with timbles, stems, operating stands, and appurtenances, to Michigan Valve & Fdry. Co., 1 North LaSalle St., $11,683. Bids June 4, awarded June 21. Noted May 31.

BRIDGE LUMBER, etc.—**Indiana**—State Hy. Comn., Indianapolis, 4,200 ft. bridge lumber at Marengo, to J. H. Crawford, Crothersville, $138; 120 tons rock asphalt paving in Paoli, to Ohio Valley Rock Asphalt Co., Starks Bldg., Louisville, Ky., $1,224. Bids May 31. Noted May 24.

CRUSHED AGGREGATE—**Indiana**—State Hy. Dpt., Indianapolis, 2,800 tons crushed aggregate at Turnerville, to Monon Crushed Stone Co., Monon, $3,360•••300 tons crushed aggregate at Griffith, to National Stone Co., Peoria, Ill., $330. Bids May 29.

CRUSHED AGGREGATE, etc.—**Indiana**—State Hy. Comn., Indianapolis, 3,300 tons crushed aggregate at Barnard, to Ohio & Indiana Stone Co., Greencastle, $5,115•••9,336 ft. bridge lumber, at Milltown, to J. W. Crawford, Crothersville, $308•••135 tons rock asphalt in Dale, to Natural Rock Asphalt Co., Heyburn Bldg., Louisville, Ky., $1,377. Grand total $6,800. Bids May 31. Noted May 24.

CRUSHED AGGREGATE—**Indiana**—State Hy. Comn., Indianapolis, 400 tons crushed aggregate, Maynard, to Moulding Brownell Co., 165 West Wacker Dr., Chicago, Ill., $552•••100 tons, at Hartsdale, to National Stone Co., Peoria, Ill., $110•••2,100 tons, Sunman, to Monon Crushed Stone Co., Monon, $2,520. Grand total $3,182. Bids May 28.

CRUSHED AGGREGATE—**Indiana**—State Hy. Comn., Indianapolis, 2,000 tons crushed aggregate, McCool, to National Stone Co., Peoria, Ill., $3,260. Bids May 21.

CRUSHED AGGREGATE—**Indiana**—State Hy. Comn., Indianapolis, 400 tons crushed aggregate at Union Center, to Material Service Corp., 33 North LaSalle St., Chicago, Ill., $552. Bids May 15. Noted May 10.

CRUSHED AGGREGATE — **Indiana** — State Hy. Comn., Indianapolis, 300 tons crushed aggregate at Pinola, to Mono Crushed Stone Co., Monon, $405. Bids May 31. Noted May 10.

CRUSHED AGGREGATE — **Indiana** — State Hy. Comn., Indianapolis, 2,600 tons crushed aggregate in St. Johns, to Monon Crushed Stone Co., Monon, $2,800. Bids May 28.

CRUSHED AGGREGATE — **Indiana** — State Hy. Comn., Indianapolis, 300 tons crushed aggregate at Sevier, and 2,200 tons at Crown Point, to Monon Crushed Stone Co., Monon, $390 and $2,816 respectively. Bids May 18. Noted May 10.

LIMESTONE SCREENINGS, etc. — **Indiana**—State Hy. Comn., Indianapolis, 8,500 tons crushed limestone screenings at Nashville, to Bloomington Crushed Stone Co., Bloomington, $11,645•••200 tons crushed aggregate at Porter, to Monon Crushed Stone Co., Monon, $240•••6 electric water coolers at Fort Wayne, to Westinghouse Electric Supply Co., 545 Madison Ave., Indianapolis, $1,110. Grand total $12,995. Bids May 31. Noted May 24.

ROCK ASPHALT, etc.—**Indiana**—State Hy. Comn., Indianapolis, 115 tons rock asphalt, Madison, to Ohio Valley Rock Asphalt Co., Starks Bldg., Louisville, Ky., $1,069•••500 wood posts, Fort Wayne, to Home Lumber Co., 241 North Pine St., Indianapolis, $160•••000 tons crushed aggregate, New Carlisle, to Monon Crushed Stone, Monon, $780•••500 wood posts, at Warsaw, to Hoosier Fence Co., $5269 Central Ave., Indianapolis, $165. Grand total $2,174.

WOOD POSTS—**Indiana**—State Hy. Comn., Indianapolis, 2,000 wood posts at Richmond, to T. Bane, Linton, $440. Bids May 14.

WOOD POSTS—**Indiana**—State Hy. Comn., Indianapolis, 1,000 wood posts, Kokomo, to T. Bane, Linton, $300. Bids May 14.

ROAD OIL—**Brookville, Ind.**—Bd. City Comrs., furnishing, applying 10,000 gal. road oil for streets, to H. W. Lyons, Brookville, $7,758. Noted June 7.

ROAD OIL—**Cannelton, Ind.**—City, furnishing, applying 15,000 gal. road oil on streets, to May & McMahon, New Albany. Noted May 10.

ROAD OIL—**Clinton, Ind.**—City, furnishing road oil for 20 mi. of city streets, to J. P. Johnson Co., 2100 South Harding St., Indianapolis, 5.06c. per gal. Noted June 21.

GRAVEL — **Noblesville, Ind.** — Bd. Comrs. Hamilton Co., gravel for county roads, to S. A. Hudson, Carmel, $1,450. Bids June 4.

ROAD OIL, etc.—**Noblesville, Ind.**—Hamilton Co., 34,000 gal. road oil, to J. P. Johnson, 2100 South Harding St., Indianapolis, $4,549; gravel, to Baker Gravel Co., Noblesville, .60c. per ton. Bids June 16. Noted June 7.

ROAD OIL—**Wabash, Ind.**—City, furnishing, applying 70,000 gal. road oil, to Paving Products Co., Peru., $7,595. Noted May 24.

BITUMINOUS MATERIALS, etc. — **Iowa** — State Hy. Comn., Ames, to White Eagle Oil Corp., Federal Reserve Bank Bldg., Kansas City, Mo., 30,000 gal. bituminous material, Boone Co., $1,611; 32,000 gal. Hamilton Co. $1,731; 50,000 gal. binder Warren Co. $3,152; 8,000 gal. RO-4, Harrison Co. $433; 18,000 gal. MC-2, Adams Co. $1,013•••to Wheeler Lumber Bridge & Supply Co., Des Moines, 40,000 gal. bituminous material in Warren Co. $4,396; 26,000 gal. material, Harrison Co., $2,894•••to L. J. Peters, Des Moines, 1,400 cu.yd. gravel Warren Co. $3,500; 550 cu.yd. crushed stone, Warren Co, $1,375; to G. W. Lamson, 80 East Jackson St., Chicago, Ill., 40,000 gal. AO-1 binder, Taylor Co. $2,169•••to Standard Oil Co. of Indiana, Equitable Bldg., Des Moines, 40,000 gal. MC-2 $546; 8,000 gal. Clark Co. $443. Grand total $23,263. Bids June 19. Noted June 14.

PIPE, etc. — **Paxton, Mass.** — Town, Bd. Water Comrs., Town Hall, c.i. pipe and fittings for water supply system, to Central Fdry. Co., 420 Lexington Ave., New York, $23,394•••valves, to Chapman Valve Mfg. Co., 71 A St., South Boston•••hydrants, to R. D. Wood, 400 Chestnut St., Phila., Pa.

†COARSE AGGREGATE, CEMENT, etc.—**Duluth, Minn.**—U. S. Eng., Canal Park, 450 cu.yd. coarse aggregate, to Duluth Crushed Stone Co., 1014 Fidelity Bldg., $923•••steel reinforcing bars, to Zalk Joseph Co., 300 East Michigan Ave., $349•••3,950 sacks of portland cement and norway pine 11 for breakwater repairs in Two Harbors, to Two Harbors Lumbers Co., Two Harbors, $2,765 and $455 respectively. Grand total $4,492.

†*Federal Government.*

Materials, etc. (Continued)

ROAD OIL—Jefferson City, Mo.—State Hy. Comn., furnishing, heating, hauling and applying 184,294 gal. road oil on 80.73 mi. roads, to Rock Hill Asphalt Co., Clayton. $11,334. Bids June 15.

†CURRENT COLLECTORS—Kansas City, Mo.—U. S. Eng., 10 current collectors for power cable reels for dredges and booster barges, to Tinling-Powell Co., 27 Main St., Spokane, Wash., $4,600. Bids May 21.

SEWER PIPE—Albuquerque, N. M.—City, furnishing 632 lin.ft. rein.-con. sewer pipe, to Lock Joint Pipe Co., 1716 California St., Denver, Colo., $2,000.

ELECTRIC GENERATOR—Middletown, N. Y.—Dpt. Mental Hygiene, State Office Bldg., Albany, electric generator for Homepathic Hospital, to Martin Epstein, 597 Monroe St., Brooklyn, $25,400. Bids Apr. 11. Noted Mar. 22.

PIPE, etc.—Appleton, Wis.—Appleton Water Comn., 700 lin.ft. 10 in. c.i. pipe and fittings to J. B. Clow & Sons, 201 North Talman Ave., Chicago, Ill., at $1.505 per ft. and $100 per ton respectively. Bids May 16.

†FIR—Milwaukee, Wis.—U. S. Eng., 76,089 M.B.M. No. 1 common Douglas fir for crib construction, f.o.b. Seattle, Wash., to E. Hines Lumber Co., 2302 East Beverly Rd., $1,396. Bids June 11, awarded June 20.

FOREIGN

England, Dunstable—A. S. Sphinx Sparking Plug Co. Ltd., plans for factory $25,000••• City Architect will take bids in July 500 houses, $900,000.

England, Slough—Bucks Educ. Committee plans to be prepared and bids called during summer for schools. $680,000.

England, Southend-on-Sea—E. A. Shore, 20 Berkeley St., London, preparing plans for theatre. $1,125,000.

Manchoukuo, Hsingking — Manchoukuo Empire, Hsinking, plans group governmental office buildings. $1,500,000.

Union Soviet Socialist Republics—Soviet Government, Moscow, or c/o Amtorg Trading Corp., electrically operated lumber mills, 600,000 cu. meters annually, in northern region in Yemzov Forest, day labor and technical aid contracts, $2,500,000.

Union Socialist Soviet Republics—Soviet Government, Moscow, or Amtorg Trading Corp., 261 5th Ave., New York, constructing new city near Yaroslave, day labor. $69,000,000.

Union Socialist Soviet Republics — Soviet Government, Moscow, or c/o Amtorg Trading Co., 261 5th Ave., New York, cellulose pulp mill, 100,000 tons annually, in Vzvoz (Northern Region), by day labor. To exceed $200,000.

U. S. S. R., Kramatorsk—Commissariat of Heavy Industry, Soviet Government, Moscow, or c/o Amtorg Trading Corp., 261 5th Ave., New York, additional units to heavy machinery works, day labor. $1,000,000 or more.

PUBLIC BUILDINGS

PROPOSED WORK

Calif., Los Angeles — Bd. Educ. approved sketches by C. M. Winslow, 1001 Architects Bldg., and authorized same to proceed with preparation of architectural working drawings, and H. A. Nelson, structural engr., 312 Associated Realty Bldg., to proceed with structural plans for reconstruction, rehabilitation and strengthening of West, East and South buildings at Miramonte School, 1400 East 68th St. $135,359. Noted Mar. 29.

Calif., Newport Beach—Newport Elementary School, plans by D. B. Kirby, 119 North Kenwood St., Glendale, new elementary school, on site of former school and may be so built that founds., floors and partitions in wing of old building can be utilized. Est. $110,000.

Calif., San Bernardino—San Bernardino Valley Junior College, plans school buildings, incl. auditorium, technical buildings, women's gymnasium. $350,000. P.W.A. approved application for loan to finance construction of same. Noted Jan. 25.

Calif., San Francisco—City and San Francisco Co. plans being completed by M. J. Rist, Phelan Bldg., 5 and 6 story, Class A, steel, concrete, brick cancer building and psychopathic hospital, Potrero Ave. and 22nd St. $615,000.

Calif., San Francisco—City and San Francisco Co., commissioned G. Kelham, 315 Montgomery St., W. P. Day, Financial Center Bldg., and J. Bakewell, Jr., 251 Kearny St., to prepare plans for Class "A" rein.-con., steel junior high school, $375,000; also commissioned L. P. Hobart, Crocker Bldg., and Bliss & Fairweather, Balboa Bldg., to prepare plans for Class "A" probably rein.-con., steel school, Brompton St. $300,000. Noted Jan. 11.

Calif., San Francisco—City and San Francisco Co., commissioned D. A. Riedy, archt., Pacific Bldg., and C. E. Rogers, archt., Phelan Bldg., to prepare plans class "A" probably rein.-con., steel school, 30th Ave., $115,000; plans by Hyman & Appleton, 68 Post St., and A. G. Lansburgh, 14 Montgomery St., for Class "A," probably rein.-con., steel school, Scherwin St., $250,000.

Fla., Miami Beach — City voted $700,000 bonds for 3 new schools and furnishing same, remodeling 1 other school. V. C. Kussero, chn. School Bd. Noted Mar. 1.

Mass., Chicopee—City, Mayors Office, Chicopee City Hall, takes bids when P.W.A. loan is approved for brick, steel hospital. $105,000. H. J. Tessier, 220 Dwight St., Springfield, archt. Noted Mar. 1.

Mass., Springfield—City, H. Martin, mayor, City Hall, plans brick, steel grade school, Liberty Heights. $150,000. Architect not appointed.

Mich., Eloise—Wayne Co. Auditors, Wayne Co. Bldg., plans by N. O. Gould, 602 Empire Bldg., Detroit, 2 story, basement, brick, rein.-con., warehouse, plain found., Michigan Ave. $247,000. P.W.A. project.

Mich., Mt. Pleasant—City plans by Merritt & Cole, 1111 Collingwood Ave., Detroit, 2 story, basement, brick, steel, stone, concrete administration building, plain found., for city offices and library. $150,000.

Faster News Service

The McGraw-Hill Construction Daily reports news of proposed work, bids asked, low bidders and contracts awarded, five times per week by first class mail. Subscription rate $10 per month. Business News Department, Engineering News-Record, 330 W. 42nd St., New York, N. Y.

N. Y., Hempstead — School Dist. voted to spend $350,000 for school expansion, incl. high school addition $219,000; Washington Street Grade School addition $45,000; Jackson School addition $26,000; and heating plant for Prospect Street School. $12,000. Noted Apr. 26.

N. Y., Holland Point—Central School Dist., c/o F. Carr, dist. supt., Barnveld, plans central school. $200,000. Architect not appointed.

N. Y., New York—S. Levy, pres. Manhattan Boro. Municipal Bldg., plans by C. B. Meyers, 31 Union Sq., 24 story criminal courts building, Franklin St. $17,000,000. H. W. Corbett, 130 West 42nd St., consult. archt.

†N. Y., New York—Treas. Dpt. at office Sup. Archt., Wash., D. C., soon takes bids 11 or 18 story, limestone post office, West Bway., Barclay, Vesey and Church Sts. $6,200,000 appropriated. Lewis & Mills, 250 Park Ave., and Cross & Cross, 515 Madison Ave., archts. Noted Dec. 1, 1932.

O., Galion—City plans municipal light plant improvements. $160,000. William C. Kammerer & Associates, 823 Prospect Ave., Cleveland, consult. engrs.

Pa., Penn Argyle—School Dist., sketches by Jacoby & Everett, Commonwealth Bldg., Allentown, 2 story, basement, 100x250 ft. new high school. $120,000. Noted Apr. 26.

Tex., Gladewater—Bd. Educ. c/o T. J. Sturdevant, pres., voted $200,000 public schools. Noted June 7.

Wash., Seattle—City Council soon takes bids constructing Diablo power house at Skagit hydroelectric project. $5,000,000 bond issue recently sold. City Light Dpt. will probably install itself 2 complete 95,000 hp. generating units and construct 7 mi. transmission line from Diablo to Gorge plant. J. D. Ross, Supt. Lighting in charge of clearing power lines from Reflector bar and installing water system at camp by own forces. Noted May 11, 1933.

Wis., Milwaukee—Bd. School Directors, 1111 West 10th St., plans by G. E. Wiley, 1008 West Highland St., remodeling Palmer School $110,000; 21st St. School $64,500; Hopkins St. School $62,500; Eng. Field School $87,500; and Windlass School $401,710.

Wis., Wisconsin Rapids — City, C. Cajanus, City Hall, plans by A. F. Billmeyer & Son, Wisconsin Rapids, 1 story, basement, 50x225 ft., brick, steel clothing factory. S & S Clothing Co., Wisconsin Rapids, lessee will purchase equipment.

BIDS ASKED

†Calif., Oakland—J. Plachek, archt., Berkeley Bank Bldg., Berkeley, taking bids on revised plans reconstructing office buildings and additions, 15th and Clay Sts., for Federal Land Bank, Oakland. Noted June 21.

†D. C., Wash.—July 3, by Treas. Dpt. at office Sup. Archt., Wash., D. C., additional transformers, at U. S. Dpt. Commerce Building.

†D. C., Wash.—July 6, by Treas. Dpt. at office Sup. Archt., Wash., D. C., exterior lighting for federal building.

La., Alexandria — July 17, by Commission Council, J. H. Brewer, sec.-treas., municipal power plant improvements, involving (1) three 750 hp. boilers with superheaters and accessories, erected on customer's found. (2) 2 forced draft fans (3) 1 feed water heater (4) 3 boiler feed pumps (5) 2 fuel oil heaters and pumps (6) 2 Desuperheaters and pressure reducing valves, all delivered f.o.b. Alexandria (7) all piping for steam, water, gas and oil, incl. valves, bends, fittings, furnished and installed also installation of Items 2, 3, 4, 5 and 6 (8) furnishing all equipment and labor and construct entire work, outlined in Items 1 to 7 inclusive (9) reconditioning steam turbine 4,000 kw. General Electric turbo-generator set (10) replacing steam turbine of 2,500 kw. General Electric turbo-generator set (11) exchanging present 2,500 kw. unit for new 2,500 kw. unit for revised conditions, 375 lb. gage, 700 deg. F. (12) exchanging present 2,500 kw. unit for new 4,000 kw. unit, for revised conditions, 375 lb. gage, 700 deg. F. (13) furnishing all equipment for entire work as outlined in Items 9 and 10 (14) furnishing all material and labor and construct rein.-con. chimney, interior diam. 9 ft. height, 175 ft. on customers pile found., P.W.A. Project 1995. Est. $250,000 incl. boiler house.

†Minn., Detroit Lakes—July 13, by Treas. Dpt. at office Sup. Archt., Wash., D. C., U. S. Post Office.

Minn., Winona—July 11, by Bd. Educ., 3rd St., 2 story, basement, 157x246 ft., stone, brick school. $300,000. Boyum, Schubert & Sorenson, 117 West 3rd St., archts. Noted Oct. 26.

N. Y., Albany—City, City Hall, bids about July 15, altering building into office for city, Washington Ave. $105,000. M. T. Reynolds, 100 State St., archt. Noted May 17.

†N. Y., Carthage—July 11, by Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office. Noted Feb. 2.

N. Y., Dover Plains—July 12, by School Bd., 2 story, basement, 68x102 ft. grade school, Pember & Demers, 25 James St., Albany, archts.

N. Y., Elmira—July 12, by Commissioner Correction, State Office Bldg., Albany, electric generator, power house, Elmira Reformatory.

N. Y., Jamestown—July 12, by Bd. Educ., F. Rogers, secy., 4th and Pine Sts., 3 story, 160x243x208x200 ft. brick, terra cotta senior high school with 80x145 ft. auditorium and gymnasium wing and 45x60 ft. music wing, East 2nd St. $750,000. Beck & Tinkham, 30 Bailey Bldg., archts.

N. Y., Kings Park—July 11, by Dpt. Mental Hygiene, State Office Bldg., Albany, heating work, sanitary work, kitchen equipment, kitchen and dining room portion of continued treatment group, Building 42, Kings Park State Hospital.

N. Y., Orangeburg—July 11, by Commissioner Dpt. Mental Hygiene, State Office Bldg., Albany, heating work, sanitary work, kitchen equipment for administration building (Children's Group), Rockland State Hospital.

N. Y., Pine Aire Station—July 18, by Commissioner Dpt. Mental Hygiene, State Office Bldg., Albany, sanitary work and equipment, kitchen equipment, kitchen and dining room building 21, male reception building 22, medical and surgical building 23 and female reception building 24, Pilgrim State Hospital.

N. Y., Poughkeepsie—July 11, by Commissioner Dpt. Mental Hygiene, State Office Bldg., Albany, constructing power plant addition, incl. equipment, heating, sanitary and electrical work at Hudson River State Hospital.

O., Hamilton—July 9, by R. Price, city mgr., 4 and 5 story, basement, 150x220 ft., brick, stone, rein.-con. municipal building. $542,000. P.W.A. project. F. G. Mueller, et al., Hamilton, archts. W. E. Bodenstein, 2nd Natl. Bank Bldg., Cincinnati, engr. Noted Apr. 21.

Okla. Chickasha—July 10, by B. B. Barefoot, chn. School Bd., 3 story, basement, 118x180 ft., brick, rein.-con. high school, plain found. $250,000. P. Harris, Chickasha, archt.

Pa., Harrisburg—July 11, by J. L. Hanna, Dpt. Property & Supplies, Harrisburg, concrete founds., ducts, fans, motors, dehumidifiers, refrigerating equipment, heaters and all necessary auxiliary equipment in connection with air conditioning House and Senate chambers. $40,000. Former bids rejected. Noted May 17.

Pa., Reading—July 6, by Associated Architects of Reading, 147 North 5th St., 2 story, basement, sub-basement, 360x460 ft., brick, steel school, plain found., $1,500,000; also complete electrical work and installation, $15,000. Noted May 17.

†S. C., Charleston—July 18, by Treas. Dpt. at office Sup. Archt., Wash., D. C., new boilers in U. S. Post Office.

†S. D., Aberdeen—July 17, by Treas. Dpt. at office Sup. Archt., Wash., D. C., 2 new heating boilers, etc. in U. S. Post Office and Court House.

†Va., Norfolk—July 6, by Treas. Dpt. at office Sup. Archt., Wash., D. C., miscellaneous changes and laundry equipment for U. S. Marine Hospital.

†Va., Norfolk—July 10, by Treas. Dpt. at office Sup. Archt., Wash., D. C., 2 mail chutes at U. S. Post Office.

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†Federal Government.

Public Buildings (Continued)

†Va., Quantico—July 11 (extended date), by Yards & Docks, Navy Dpt., Wash., D. C., constructing bachelor officers quarters, Spec. 7002. Noted June 21.

†C. Z., Summit—Yards & Docks, Navy Dpt., Wash., D. C., taking bids buildings, roads, services at Naval Radio station, Spec. 7515. (Date not set.)

LOW BIDDERS

N. Y., Bayside—W. C. Martin, archt. and supt. School Buildings, Flatbush Ave. and Concord St., Brooklyn, June 25, general contract Bayside High School, from Royal Rice Co., Inc., 136 East 57th St., New York, $1,339,370; sheet metal duct work, from A. T. Morris Co., 41-15 23rd St., Long Island City, $17,760, for Bd. Educ., 500 Park Ave., New York. Noted June 21.

CONTRACTS AWARDED

†Ala., Montgomery — Con. Q.M., Maxwell Field, 25 officers quarters, to Paul Bros. Co., Maxwell Field, $15,570. Bids June 12.

†Ariz., Whipple—Vet. Bu., Arlington Bldg., Wash., D. C., refrigeration in Buildings 45, 47 and 81 of U. S. Veterans Hospital, to Kohlenberger Eng. Co., Fullerton City, Calif., $45,480. Bids June 12. Noted June 7.

†Calif., San Francisco—Treas. Dpt. at office Sup. Archt., Wash., D. C., interior lighting fixtures in federal building, to H. A. Framburg & Co., 3320 Carroll Ave., Chicago, Ill., $8,478. Bids May 22. Noted May 3.

Calif., San Francisco—De Luca & Son, Inc., general contractors, 1745 Filbert St., electrical work for machine shop at municipal airport, to H. S. Tittle, 85 Columbia Sq., for City and San Francisco Co., P. Utilities Comn., 287 City Hall. **P.W.A.** Noted May 31, under "Contracts Awarded."

†Ga., Fort Benning—Con. Q.M., 296 garages, to A. J. Honeycutt Co., Inc., Columbus, $92,506. Bids June 7.

Ind., Fort Wayne—Bd. P. Wks., constructing Div. 2, underground duct and manhole system; 13,800 volt circuits; 2,400 volt circuits, 440 volt motor circuits; field circuits; operating circuits, grounding; building lighting circuits, to Hartzell & Buehler, 420 Lexington Ave., New York, $14,500. Bids June 7, awarded June 15. Noted May 31.

Ia., Corning—City, 1 story, part basement, 48x70 ft., tile electric plant, wood pile found., distribution system, 3 diesel engines, to Fairbanks & Morse Constr. Co., 900 South Wabash Ave., Chicago, Ill., $158,258. Est. $38,000. Noted Mar. 22.

Massachusetts—Commonwealth of Massachusetts, Dpt. P. Safety, D. Needham, comr., State House, Boston, constructing state police substations on state hy. Athol, to Daniel O'Connell's Sons, Inc., 480 Hampden St., Holyoke, $38,389•••on hy., Concord, to C. H. Cunningham & Co., Inc., 31 Exchange St., Lynn, $35,990•••on hy., Norwell, to L. M. Witherell & Sons, 29 Court St., Taunton, $36,974•••on state hy., Shelburne Falls, to M. J. Walsh & Sons, 1412 Dwight St., Holyoke, $37,699••• on state hy., Yarmouth, to Greany Constr. Co., Box 830, Fall River, $38,360, all foregoing 2½ story, basement, brick, concrete construction•••2 story, basement, irregular sized, brick, concrete, state police supply building, and concrete, brick troop headquarters, both at Framingham, to I. P. Rocheford, 8 Arlington Pl., Framingham, $34,982 and $58,707 respectively. **P.W.A.** Grand total $281,101. C. H. Cunningham & Co., Inc., general contractors, 31 Exchange St., Lynn, heating and plumbing for police sub-station, Concord, to John F. Cabeen Co., 18 Cabott St., Salem; electrical work, to Fred R. Farwell Co., Inc., 51 Tilton Terrace, Lynn. Bids May 10, awarded June 21. Noted May 3.

†Mass., Hingham — Yards & Docks, Navy Dpt., Wash., D. C., repairing stucco building at Naval Ammunition Depot, Spec. 7629, to Cement Gun Co., Allentown, Pa., $10,802. Noted June 7.

†Mass., Holyoke—Treas. Dpt., Wash., D. C., heating for post office, to Quistberg & Schiaveni, Hartford, Conn.•••plumbing, to O. Epstein, Inc., 549 Front St., Hartford, Conn. •••electrical work, to A. C. Senecal, Westboro. Noted Apr. 26, under "Contracts Awarded."

Mass., Westboro—Commonwealth of Massachusetts, Dpt. Mental Diseases, State House, Boston, general contract 2 story, basement, 36x176 ft. rear center development at State Hospital, to J. G. Roy & Sons Co., 21 Silver St., Springfield, $129,372. **P.W.A.** Bids May 11, awarded June 15.

Mass., Westfield—Commonwealth of Massachusetts, Company F, 104th Regiment, State Quartermaster, State House, Boston, 2 story, basement, 97x120 ft., brick, limestone armory, to E. J. Pinney Co., Inc., 220 Dwight St., Springfield, $103,616. **P.W.A.** Bids May 17, awarded June 20.

N. H., Dover—City, F. C. Keefe, mayor, general contract 2 story, basement, tower, 72x158 ft. and 53x70 ft., brick, limestone municipal building, concrete found., to Osgood Constr. Co., 25 East Hollis St., Nashua, $227,626. **P.W.A.** Bids May 28, awarded June 19. Noted May 17.

N. Y., Unadilla—School Bd., heating for school, to American Warming & Ventilating Co., Pennsylvania Ave., Elmira•••plumbing, to Schlafer & Krager, 108 Front St., Deposit••• electrical work, to M. H. Salmon Electric Co., 944 West Genesee St., Syracuse. Noted May 31, under "Contracts Awarded."

N. Y., Wolcott — Bd. Educ., constructing Leavenworth Central School, to Benz Eng. Co., Salamanca, $330,000. **P.W.A.** Noted June 7.

N. Y., Wolcott—Bd. Educ., heating for school, to F. Bradt Co., Inc. 113 Oakwood Ave., Syracuse, $46,980•••plumbing, to E. G. Snyder Co., Inc., 86 Scio St., Rochester, $36,192•••electrical work, to Conheady-Langschwager, Inc., 14 Curtis St., Rochester, $20,329. Grand total $103,501. **P.W.A.** Bids June 11. Noted June 28, under "Contracts Awarded."

O., Toledo—J. A. Nast, pres. Bd. Trustees University of Toledo, housing units for faculty and students. (3 new buildings), to H. M. Martens, 2111 Woodward Ave., Detroit, Mich., $245,800 (tentative award). **P.W.A.** Noted Apr. 19.

†Va., Virginia Beach—U. S. Property & Disbursing Officer, constructing 24 kitchens and mess halls at State Rifle Range, to E. E. Weddle & Co., Norfolk, $58,248. Bids June 18. Noted June 21.

Wash., Seattle—See "Proposed Work."

†C. Z., Fort Clayton—Con. Q.M., Panama Canal Dpt. Quarry Heights, 2 sets officers quarters, to Grebien & Martinz, of Panama, $35,990. Bids June 4. Noted May 17.

COMMERCIAL BUILDINGS

PROPOSED WORK

Calif., San Francisco—Society of California Pioneers, 44 4th St., plans being completed by A. R. Denke, 1429 Bway., Oakland, general reconstruction of hotel, 4th St. near Market St. $110,000.

Conn., Hartford—Trinity College, bids late in August or thereafter, general contract 3 story, brownstone chemistry building at south end Trinity Campus, Summit St. $400,000, a gift donated by anonymous donor. McKim, Mead & White, 101 Park Ave., New York, archts.

Conn., Middlebury—Westover School, J. P. Elton, chn., Bd. Directors, 70 Church St., Waterbury, sketches by E. B. Goodall, Jr., 234 Boylston St., Boston, Mass., stone memorial library unit, Westover School. $105,000.

Conn., West Hartford (br. Hartford)—Owner, c/o W. P. Crabtree, Jr., archt., 110 Asylum St., Hartford, making plans developing large real estate plot incl. 5 to 7 room colonial cottages, along South Main St. and Park Rd. To exceed $100,000.

Ind., Indianapolis—Hoosier Casualty Co., 1510 Fletcher Trust Bldg., plans by McGuire & Shook, 1401 Fletcher Trust Bldg., 2 story, basement, 69x185 ft., limestone, steel office and store building. $165,000.

Mass., Amherst—Amherst College, C. A. Andrews, treas., plans new brick, steel gymnasium on campus. $105,000. Architect not appointed.

Mass., Boston—I. J. Fox, 403 Washington St., plans by Shepard & Stearns, 65 Franklin St., Boston, and Elias Rothschild & Co., 580 5th Ave., New York, 7 story, basement, brick, steel, concrete fur store and storage, concrete found., Washington St. To exceed $150,000.

Mass., North Cambridge—J. A. McPherson, archt., 8 Irvington St., Boston, soon lets contract, 1½ story, basement, 85x155 ft., brick, stone, granite church, concrete found., for Immaculate Conception Church, M. Manning, pastor, $150,000.

Mass., Salem—Holyoke Mutual Fire Insurance Co., 114 Washington St., plans by P. H. Smith, 80 Boylston St., Boston, office, Norman and Crombie Sts. To exceed $105,000. Noted June 7.

Mo., St. Louis—St. Gabriel the Archangel Roman Catholic Parish, c/o F. H. Skaer, 5605 Lisette Ave., preliminary studies by A. F. and A. Stauder, 6032 South Kingshighway Blvd., 2 story, basement, 59x109 ft., church and parochial school, Tamm and Murdoch Sts., $75,000-$105,000. **Maturity indefinite.**

N. Y., Brooklyn—Corporation, c/o J. Poret, 510 Ditmars Ave., plans by Cohn Bros., 191 Joralemon St., 6 story, 80x100 ft. apartment, East 19th St. and Dorchester Rd. $110,000.

N. Y., Brooklyn—G. Goldberg, 808 East 18th St., plans by Kavy & Kavovitt, 16 Court St., 6 story apartment, East 17th St. and Albermarle Rd. $200,000.

N. Y., New York—V. Astor, 23 West 26th St., plans by W. H. Wagner, 1461 University Ave., altering plumbing and new heating work, for 5 story, apartment, 541 East 88th St. $28,000 with equipment.

N. Y., New York—Leopold Bucksbaum, 102 West 99th St., plans by H. M. Sohn, 38 East 38th St., heating, plumbing, boiler room, etc., in apartment, 153 West 84th St. $28,000.

N. Y., New York—Arthur Enterprise, Inc., 560 West 180th St., plans by W. I. Hohauser, 17 West 44th St., refrigerating and air conditioning theatre, 560 West 181st St. $40,000 or more.

N. Y., New York—Estate of Goelet, 606 5th Ave., plans by Cross & Cross, 515 Madison Ave., plumbing, air conditioning and refrigeration in bank and stores, 606 5th Ave. $75,000.

N. Y., New York—Estate of R. Goelet, 608 5th Ave., plans by R. C. Morris, 522 Ocean Ave., Brooklyn, new heating plant and altering plumbing for apartments and stores, 173 East 62nd St. $28,000.

N. Y., New York—Metropolitan Life Insurance Co., 1 Madison Ave., plans by E. Roth, 18 East 48th St., heating and plumbing alterations to 12 story apartments, 510 Cathedral Parkway. $65,000.

N. Y., New York—Metropolitan Opera & Real Estate Co., Bway. and 39th St., plans by J. G. White Eng. Corp., archts. and engrs., 43 Exchange St., opera house modernization, incl. lighting system, elevating orchestra pit, electrical equipment, etc., Bway. and 39th St. $600,000 with equipment.

N. Y., New York—One Hundred Fifteen East 72nd St., Inc., 285 Madison Ave., plans by Schwartz & Gross, 347 5th Ave., apartment, 115 East 72nd St. $115,000.

N. Y., New York—W. F. Weschbrodt, 34 Beekman Pl., plans by O. A. Standt, 45 West 52nd St., elevator, dumbwaiter, boiler room, heating, etc., in apartment, 32 Beekman Pl. Est. about $28,000.

N. Y., Richmond Hill—Long Island Amusement Co., Theatre Bldg., Hillside Ave., plans refrigeration and air conditioning for theatre. Est. about $30,000.

N. Y., Syracuse—Roman Catholic Church of Assumption, 806 North Salina St., soon lets contracts (11st unit) church and parish hall, also rectory, and parish office building, 806-12 North Salina St. $350,000. H. P. Webber, 814 North Salina St., archt.

Pa., Allentown—Christ Lutheran Church, c/o Rev. H. Kinard, 21 North 13th St., plans by Ruhe & Lang, 21 North 6th St., 2 story, basement, 75x150 ft., steel addition, plain found., and altering old building, Hamilton and 13th Sts. Est. $135,000.

Pa., Chester—A. R. Boyd Enterprises, Inc., Chester, plans by Hoffman-Henon Co., 20th and Race Sts., Phila., and soon takes bids theatre building with 6 stores on front, 8th and Walsh Sts. $150,000.

Pa. Phila.—Lewis Baker Estate c/o Lionel Friedman, Inc., 15th and Locust Sts., soon lets contract, new store, 1520 Chestnut St. Est. $125,000. Silverman & Levy, 313 South Smedley St., archts. S. S. Kresge Co., New York, lessee. Noted Mar. 8.

Wash., Vancouver—Pacific Telephone & Telegraph Co., F. W. Sinclair, mgr., Vancouver, plans office, Washington St. $195,000. Private plans.

BIDS ASKED

O., Cincinnati—Rendings, Panzer & Martin, archts., Southern Ohio Bank Bldg., taking bids 3 story, basement, 100x125 ft. addition to art museum, plain found., Eden Park, for Cincinnati Art Museum, c/o W. D. Siple, dir. $250,000, Fosdick & Hilmer, Union Trust Bldg., engrs. Noted May 3.

Mich., Detroit—A. Des Rosiers, archt., 1418 Macabees Bldg., taking bids 2 story, basement, 85x115 ft., brick, steel, concrete, stone church, Dubois St., for St. Joachin Church, Dubois and Congress Sts. $115,000. Noted May 10.

N. Y., Brooklyn—See "Contracts Awarded."

Que., Oka—See "Contracts Awarded."

CONTRACTS AWARDED

Colo., Colorado Springs—Mrs. F. M. P. Taylor, Colorado Springs, contract art center for Broadmoor Art Academy, Broadmoor Dist., to Platt Rogers, Inc., Pueblo, and G. O. Teats, Rocky Ford. Est. $500,000. Noted Jan. 25.

Ill., Chicago—Union Stock Yards & Transit Co., Exchange Bldg., Exchange Ave. U. S. Stock Yards, to Poirot Constr. Co., 2001 West Pershing Rd., general contract 1 and 2 story, 300x530 ft., amphitheatre, exhibition halls, at U. S. Yards, est. $1,000,000; general contract 2 story, 48x125 ft., brick, concrete carpenter shop, est. $40,000; general contract 8 story, basement, 75x250 ft. exchange building, est. $500,000•••to J. J. Daly, 231 West Illinois St., plumbing for exchange building•••to W. A. Pope, 26 North Jefferson St., heating for exchange building. A. Epstein, 2001 West Pershing Rd., engr.

Ind., Anderson—Citizens Bank Bldg., C. Bonser, supt., elevators for rehabilitation of 6 story, store and office building, to Warner Elevator Co., 2531-31 Spring Grove St., Cincinnati, O. Est. $200,000. Noted Feb. 8.

Ia., Sioux City—Northwestern Mutual Life Insurance Co., 720 East Wisconsin Ave., Milwaukee, Wis., 3 story, basement, 76x150 ft. store, to Kuchars Sugarman Constr. Co., Hubbell Bldg., Des Moines. Est. $125,000. Montgomery Ward & Co., lessee. N. P. Rice, Chicago, Ill., engr.

Mass., Wellesley—C. Z. Klauder, archt., 1429 Walnut St., Phila., Pa., 3 story, basement, 54x189 ft. brick, granite, limestone physics and chemistry building at Wellesley College, to J. W. Bishop Co., 109 Foster St., Worcester; electrical work, to Edwin C. Lewis, Inc., 121 Federal St., Boston, for Wellesley College, at office of Business Manager. Est. $1,600,000. Bids May 15, awarded June 13. Noted May 10.

Mass., Weymouth — Immaculate Conception Roman Catholic Church, E. P. Murphy, pastor, 199 Commercial St., general contract 2 story.

†*Federal Government.*

Constr. News page 248

Commercial Buildings (Continued)

basement, 40x80 ft. brick, granite and cast stone convent, Commercial St., to T. F. Crowell & Sons, 19 South St., Brockton, est. approximately $150,000***heating, to J. C. Higgins, 331 Newbury St.***plumbing, to Lyons Plumbing Co., Weymouth***electrical work, to W. L. Welch, 788 Washington St., Whitman. Bids May 26, awarded June 20. Noted May 24.

N. Y., Brooklyn—Corporation, c/o L. Berg, 50 Court St., 6 story, 70x90 ft. apartment, 14th Ave. and 52nd St., to Philkam Building Corp., 50 Court St. Est. exceeds $110,000. Cohn Bros., 191 Joralemon St., archts.

N. Y., Brooklyn—Corporation, c/o J. Katekaw, 1415 55th St., apartment, Brightwater Court and Coney Island Ave., separate contracts. $180,000. M. N. Weinstein, 93 Court St., archt.

N. Y., Brooklyn—Mayer Perlman, 913 45th St., 6 story apartment, Avenue P and West 9th St., to Perlman Builders, Inc., 913 45th St., who will build by separate contracts. Est. $150,000.

N. Y., New York—Hearn's Department Store, 20 West 14th St., escalators for department store, to Otis Elevator Co., 11th Ave. and 26th St., about $40,000.

N. Y., New York—Merlis Realty Estate Co., 280 Bway., elevator work, elevators, elevator machinery, etc., for 7 story office and store, 280 Bway., to Naumer Electric Co., 60 Cliff St. Est. exceeds $28,000. Holmes & Converse, 101 Park Ave., archts.

N. Y., Woodside—Boulevard Gardens Housing Corp., 31-11 55th St., piling for ten 7 story apartments, to McArthur Concrete Pile Corp., 19 West 44th St., New York; structural steel, to J. Klein Iron Wks., 60 Bway., Long Island City. Bids on mechanical equipment and elevators after Sept. 1. Noted Dec. 7, under "Contracts Awarded."

Pa., Phila.—Temple University, Broad St. and Montgomery Ave., library, Berks St., to R. S. Herzog, 1505 Reac St. Est. $550,000. P.W.A. W. H. Lee, Schaff Bldg., archt.

Que., Oka—Trappist Fathers, Oka, 2 story veterinary hospital, also new wing on 1 of existing school buildings, $125,000, central power house and steam heating plant, $50,000, by own forces. Owners in market for machinery, boilers, material and fittings, etc. Canadian Domestic Eng. Co., Ltd., 625 Burnside St., Montreal, engrs.

INDUSTRIAL BUILDINGS

PROPOSED WORK

Calif., Fresno — PLANT — Sunland Sulphur Co. plans 41x60 ft. spray plant, 53x60 ft. fertilizer plant addition, 60x100 ft. warehouse, all corrugated iron construction. $40,000.

Calif., Modesto—BREWERY—Modesto Brewery Co. represented by W. H. Henning, 2710 Santa Clara Ave., Alameda, plans fireproof brewery. To exceed $50,000.

Calif., Long Beach — STORAGE TERMINAL — R. Franklin Strong & Associates, 112 West 9th St., Los Angeles, applied to Long Beach Harbor Comn. for lease on city-owned property fronting on Channel 3, Long Beach Harbor, and propose to erect storage terminal on site, incl. docks, bulkheads and sheds. $1,400,000.

Calif., San Francisco—FREIGHT SHED—Southern Pacific R.R., 65 Market St., plans prepared 1 story 80x176 ft. light and heavy timber freight shed, 4th and Channell Sts. Private plans.

Fla., Miami—SERVICE GARAGES, etc.—Sinclair Refining Co., 45 Nassau St., New York, plans group of service, repair stations and garages, 3600 northeast 2nd Ave. here, and other locations. To exceed $30,000.

Ind., Indianapolis — PLANT — Indiana Breweries, Inc., Indianapolis, making plans improving and addition to brewery plant, 946 West New York St. $100,000. Private plans.

Mass., Newburyport—BULK PLANT—Colonial Beacon Oil Co., Inc., 30 Beacham St., Everett, soon lets contracts bulk plant incl. tanks, pipe lines, driveways, etc., Water St. To exceed $40,000. Private plans.

Mass., Somerville—WAREHOUSE, etc.—New England Dressed Meat & Wool Co., 174 Somerville Ave., soon takes bids 1 story, basement, 50x70 ft. and 25x50 ft., brick warehouse and office, concrete found., Somerville Ave. and Medford St. $40,000. A. E. Bump, 25 Faneuil Hall Sq., Boston, archt.

Mich., Detroit — AUTO BODY PLANT — Briggs Mfg. Co., 11631 Mack Ave., Giffels & Vallet, Inc., engrs., 620 Marquette Bldg., to prepare plans 1 and 2 story, brick, steel, rein.-con., plain found., Mack Ave. $50,000.

Mich., Detroit—BREWERY STOCK HOUSE—Stroh Brewing Co., Gratiot Bldg., plans by Harley & Ellington, archts. and engrs., 1507 Stroh Bldg., 5 story, basement, sub-basement, 120x130 ft., rein.-con., steel, brick, plain found., Gratiot Ave. $125,000.

Mich., Frankenmuth—BREWERY—Frankenmuth Brewing Co. plans by Mildner & Eisen, 924 Hammond Bldg., Detroit, 2 story, basement, brick, steel, rein.-con. addition to include bottling works, plain found. $45,000. Noted Apr. 20.

Minn., South St. Paul—PACKING PLANT—Cudahy Packing Co., South St. Paul, Minn., and 33 and O Sts., Omaha, Neb., soon lets contract packing plant addition. $40,000.

N. Y., Elmira—BULK STORAGE STATION, etc. — Standard Oil Co. of New York, 26 Bway., New York, 1 story, basement, 61x116 ft., bulk storage station, office, warehouse and garage. Private plans.

N. Y., New York—GARAGE and SERVICE STATIONS—Hickey Bros., foot 6th St., Brooklyn, plans by Ross & McNeil, 274 Madison Ave., altering two 2 story, 100x100 ft. garage and service station buildings, 680 12th Ave. $28,000 or more.

N. Y., New York—SERVICE STATIONS—Standard Oil Co. of New York, 26 Bway., plans by J. F. Rieger, 32-40 57th St., Woodside, group service stations, 43 East 134th St. and other locations. To exceed $30,000.

N. Y., New York—STORAGE, etc.—Windsor Productions Ltd., 321 West 44th St., plans by J. Eberson, 92 Gold St., storage, shops and dressing rooms, 234 West 52nd St. $60,000.

O., Cleveland—DAIRY—Producers Milk Co., E. A. Thomas, pres., 4560 West 35th St., plans nearing completion by W. J. Wefel, archt. and engr., 3327 Yorkshire Rd., 2 story, basement, 60x120 ft., brick, steel addition. $60,000.

Tenn., Chattanooga—SERVICE STATION—J. Wilson, Feiger Bldg., plans brick automobile service station on Lee Hy., about 12 mi. east of here. $35,000. Architect not appointed.

Tenn., Memphis—LUMBER YARDS, etc.—Lee Lumber Co., 867 Raynor St., plans lumber yard and plant. To exceed $30,000.

Tex., Houston — INDUSTRIAL PLANT — Fitral Co. of Calif., c/o Chamber of Commerce, plans industrial plant. $300,000.

Va., Fredericksburg—PLANT—Sylvania Industrial Corp. plans repairing fire and explosion damage to plant. To exceed $100,000. Architect not appointed.

Wash., Aberdeen — DIGESTER ANNEX — Grays Harbor Pulp & Paper Co., plans 50-ton digester annex to increase daily sulphite production of pulp mill from 100 to 150 tons. $100,000.

Wis., Sheboygan—SERVICE STATION, etc.—L. Janko, 1918 Georgia Ave., plans by E. A. Stubenrauch, 809 North 8th St., 1 story, 70x76 ft., brick, concrete service station and repair shop.

Alberta and Saskatchewan—BULK OIL STATIONS—Texas Co. of Canada Ltd., c/o Texas Co., 135 East 42nd St., New York, plans group of bulk oil stations various locations in Alberta and Saskatchewan. Est. about $100,000.

B. C., Victoria—LUMBER PLANT, etc.—Moore Whittington Co., 302 David St., plans lumber and woodworking plant. To exceed $40,000. Architect not appointed.

Que., Matane—PLANT, etc.—Hammermill Paper Co., Erie, Pa., preparing plans plant here and dam on Matane River. Private plans.

BIDS ASKED

Md., Dundalk—DISTILLERY—Big Four Distilleries controlled by United Distilleries of Canada, Ltd., H. H. Klein, pres., 8900 Shaughnessy St., Vancouver, B. C., taking bids 1, 2, 3 and 4 story, distillery buildings. $500,000. Private plans.

Mo., Kansas City—BREWERY—M. J. Goetz, c/o L. A. Keck, 6th St. and Albermarle Sts., St. Joseph, bids about June 30 (from local bidders only) 3 story, basement, rein.-con., steel, Jackson Co. $500,000. G. L. Lehle, 111 West Washington St., Chicago, Ill., engr. Noted May 10.

N. H., Keene—WAREHOUSE, etc.—July 3, by S. S. Kresge Co., Construction Dpt., 2727 2nd Blvd., Detroit, Mich., 2 story, basement, 42x128 ft., brick, concrete, steel warehouse and store, concrete found., 20 Main St. $40,000 or more. Private plans. T. B. Murphy, supt. of Construction at Owners Detroit Office and R. L. Bussey, supt. in charge at site.

Tenn., Woodward—BULK STORAGE—See "Contracts Awarded."

CONTRACTS AWARDED

Ind., Indianapolis—PLANT—Richard Lieber Brewing Co., general contract rehabilitating plant, 1254 South West St., to A. J. Glaser, Lincoln Ave., Muncie; steel, to Hetherington & Berner, 701 Kentucky Ave. Est. $65,000. Vonnegut-Bohn & Mueller, 610 Ind. Trust Bldg., archts.

Mass., Everett—SUPER-SERVICE STATION—Sun Oil Co., 435 Doremus Ave., Newark, N. J., plumbing for super-service station, to G. Tack, 1579 Blue Hil Ave., Mattapan, awarded June 14. Noted May 31, under "Contracts Awarded."

Mass., Fall River—WAREHOUSE—Fall River Paper & Supply Co., 110 14th St., electrical work for 2 story, basement, 84x96 ft. warehouse, 14th and Merchant Sts., to S. Baron, 252 2nd St. Awarded June 13. Noted May 10, under "Contracts Awarded."

Mass., Lawrence—GARAGE—Eastern Massachusetts Street Railway Co., 38 Chauncy St., Boston, heating for 1 story, irregular sized, motor coach garage, to Florence & Co., 79 Sudbury St., Boston. Awarded June 16. Noted Apr. 12, under "Contracts Awarded."

Mass., Wellesley—SUPER-SERVICE STATION—Leo J. Nawn, Inc., general contractors, Magazine St., Roxbury, plumbing for super service station, Worcester Turnpike, to Lappin Bros. Co., 8 Union St., Malden; electrical work, to Balcom Bros., 29 Irving St., Malden, for Standard Oil Co. of New York, 31 St. James Ave., Boston. Awarded June 14. Noted May 31, under "Contracts Awarded."

Mich., Bay City—BULK STORAGE PLANT TANKS—Gulf Refining Co., 7th and Grant Sts., Pittsburgh, Pa., 3 steel storage tanks for bulk storage plant, to Chicago Bridge & Iron Wks., 37 West Van Buren St., Chicago, Ill. Noted June 21.

Mich., Detroit — BREWERY — Eckhardt & Becker Brewing Co., 1935 Dime Bank Bldg., 6 story, storage and distribution building for brewery, Winder and Orleans Sts., to Adler Constg. Co., 10 Parkhurst St. Noted May 31.

Mich., Detroit—CREAMERY—Detroit Creamery Co., Grand River and Sycamore Aves., 1 story, part basement, brick, rein.-con., steel creamery, plain found., St. Jean Ave., to G. Leverenz, 201 South Lakewood Ave. Est. $45,000. Awarded June 16. N. Krecke, 1005 American Radiator Bldg., Detroit, archt.

Mich., Flint—FACTORY—A.C. Spark Plug Co., rein.-con., steel, brick factory, plain found., to K. Foster, Flint. Est. $65,000. Noted Apr. 12.

N. H., Laconia—SUPER SERVICE STATION—Guay & Tardif, general contractors, 96 Summer St., heating and plumbing for 1 story, basement, irregular sized, brick, concrete super service station, to J. J. Morin, 77 New Salem St.; electrical work, to W. D. Sanborn, 632 Main St., for Standard Oil Co. of New York, 31 St. James Ave., Boston, Mass. Noted June 14, under "Contracts Awarded."

O., Cleveland—DAIRY—Producers Milk Co., E. A. Thomas, pres., 4560 West 35th St., 2 story, basement, 60x120 ft., brick, steel, concrete addition, to McKay Constr. Co., 3521 Normandy Rd. Est. $40,000. Awarded June 18, W. J. Wefel, 3327 Yorkshire Rd., archt. and engr.

O., Norwood—STORAGE, etc.—Continental Can Co., 1 Pershing Sq., New York, storage and distribution plant, to Austin Co., 16112 Euclid Ave., Cleveland. Est. exceeds $30,000.

N. M., Deming—DISTILLERY—Mimbres Valley Distillery Co., 1 and 4 story, tower, 40x100 ft. distillery, to A. C. Colson, c/o owner. Est. $80,000. F. Thatcher, Deming, engr. Noted June 7.

N. Y., Glens Falls — FACTORY — Imperial Color Wks., Inc., 1 story, basement, 50x100 ft. factory addition, Warren St., to Kingsbury Constr. Co., 158 Main St., Hudson Falls. Private plans. Awarded June 15.

N. Y., Jamaica—FACTORY—Sudom Realty Co., 89-64 163rd St., general contract 2 story, 50x76 ft. factory, Sutphin Blvd. and 94th Ave., to Durski Constr. Co., 109-52 109th St., Richmond Hill. Est. exceeds $28,000 with equipment. Noted May 24.

O., Youngstown — STEEL STRIP MILL — Mesta Machine Co., Oliver Bldg., Pittsburgh, Pa., awarded contract for electrical work at steel strip mill, Campbell Plant, for Youngstown Sheet & Tube Co., Stambaugh Bldg., to Westinghouse Electric & Mfg. Co., 150 Bway., New York, about $1,000,000.

Tenn., Woodward—BULK STORAGE—Standard Oil Co. of Louisiana, Baton Rouge, La., 3 bulk storage tanks, near Cumberland River, separate contracts. To exceed $30,000.

Wis., Menasha—STORAGE WAREHOUSE—Remich Transfer Co., 311 Layco St., 1 story, basement, 90x100 ft., rein.-con., cut stone, brick, to Charles Gambsky, Garfield Ave., Menasha.

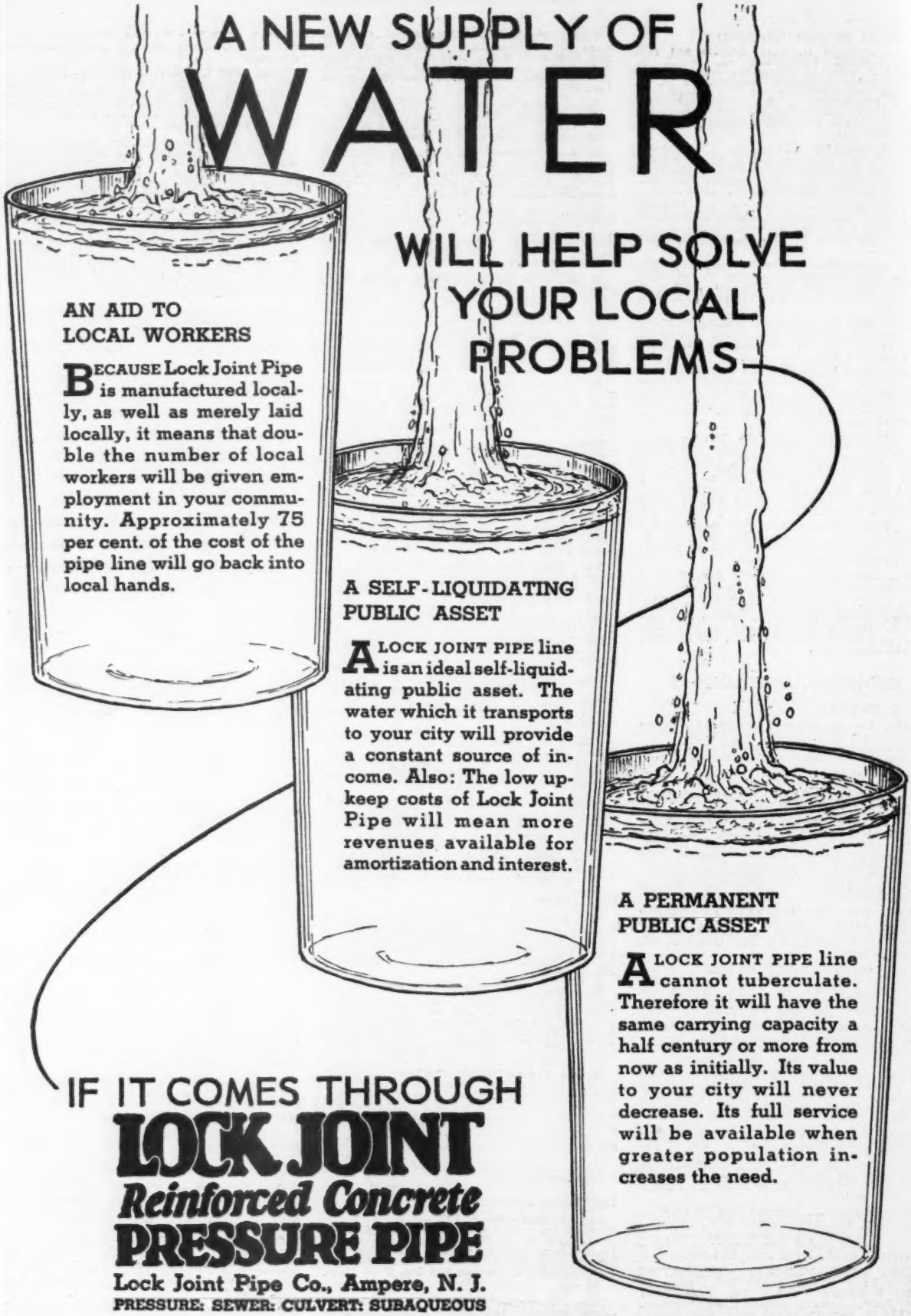
Ont., Hamilton—ASPHALT PLANT—A. Cope & Sons Ltd., 19 Albert St., asphalt plant, Dundas St. $60,000. Owner builds. Electrical work, to Dynes Electrical Co., 14 Walnut St. N.

Ont., London—BREWERY—John Hayman & Sons, general contractors, 432 Wellington St., steel for 2 brick brewery additions to London Structural Steel Co., Ltd., Burslem Ave.***roofing and sheet metal, to J. A. Brawnlee, 102 Dundas St.***plumbing, to W. A. Cox & Co., 394 Ridout St., for John Labatt Brewery, Simcoe St. Noted May 31, under "Contracts Awarded."

†*Federal Government.*

A NEW SUPPLY OF WATER

WILL HELP SOLVE YOUR LOCAL PROBLEMS



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BECAUSE Lock Joint Pipe is manufactured locally, as well as merely laid locally, it means that double the number of local workers will be given employment in your community. Approximately 75 per cent. of the cost of the pipe line will go back into local hands.

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In your business—in every business—where hauling costs are a major item of expense, Goodyears are known as MONEY SAVERS.

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Underneath that thick, slow-wearing All-Weather tread is a body of patented pre-shrunk Supertwist Cord. Supertwist, with up to 61% greater stretch than other cords, has life and elasticity long after other cords sag and fail. That extra elasticity, that extra vitality adds thousands of miles to tire life—holds your tire expense to the very minimum.

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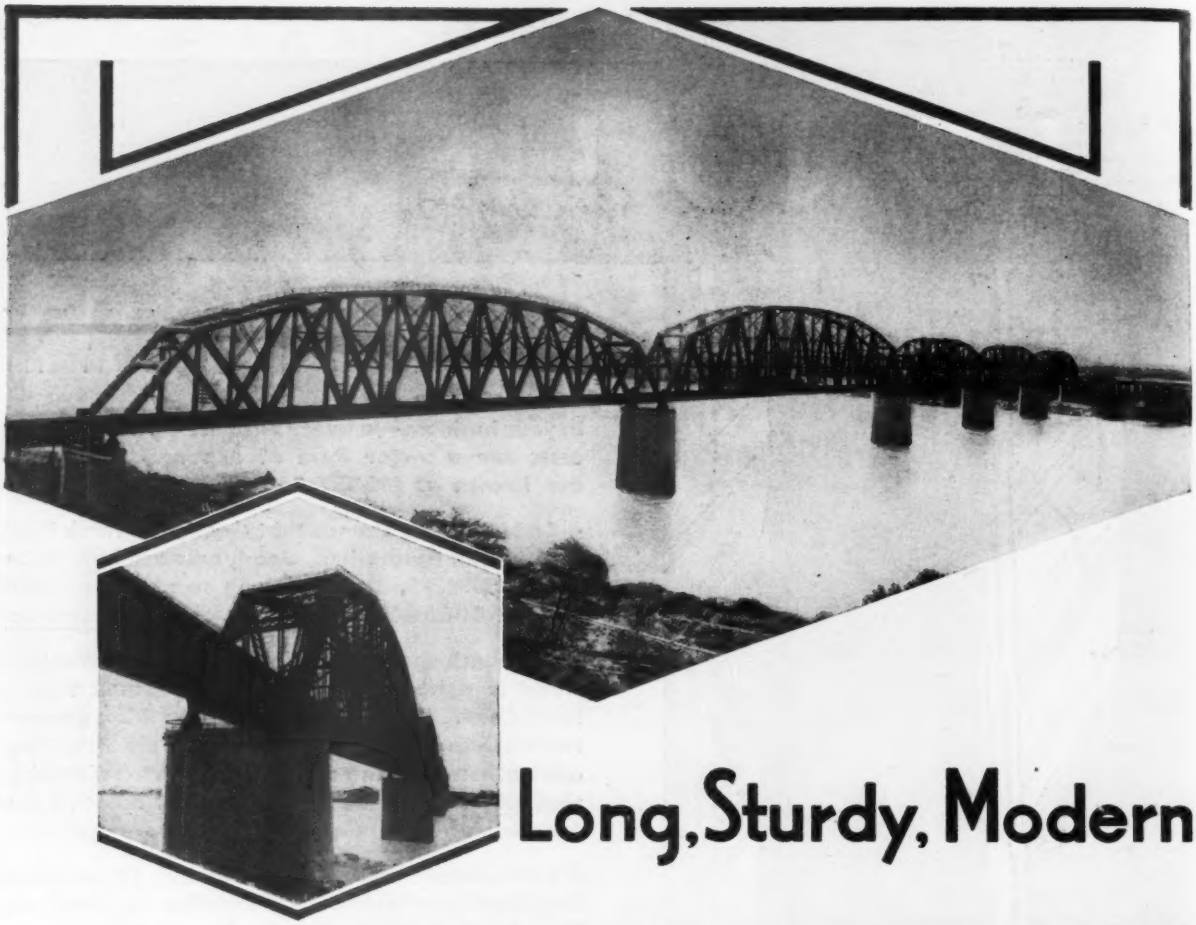
NRA

GOODYEAR

TRUCK TIRES — *Money savers*



Long, Sturdy, Modern

HENDERSON BRIDGE

THE recently completed bridge of the Louisville and Nashville Railroad over the Ohio River at Henderson, Ky., with its new approaches, has a total length of about two and a third miles. And in addition, on the Indiana side of the river a two-mile stretch of already existing trestle is to remain in use.

This bridge was located some ninety feet farther down stream from, and parallel to, a less modern one which it supersedes. The old structure, built in 1885, had served well; but the increasing weight of trains and the frequency of present traffic made replacement desirable.

The main river crossing, which rests on high masonry piers, is 3,163 feet long. For the superstructure of the double-track river spans, and the plate-girder approach on the Indiana shore, some 20,000 tons of steel was required. American Bridge Company fabricated and erected all of this material and was also commissioned to remove the old bridge.

Silicon steel and steel of copper content were very extensively used throughout the new structure. Designed to meet the demands not only of present but of probable future railway loadings, Henderson Bridge ranks now as a highly advanced piece of engineering, just as the old pin-connected fabric, part steel, part iron, was considered a masterpiece 48 years ago.

The new bridge was designed under the supervision of William Howard Courtenay, chief engineer of the L. & N. Mr. Courtenay was the engineer in charge of construction on the old bridge in 1885, a historic fact of some interest.

American Bridge Company fabricate and erect structural steel for all types of buildings and other projects, large or small.

AMERICAN BRIDGE COMPANY

SUBSIDIARY OF UNITED STATES STEEL CORPORATION

General Office: Frick Building, Pittsburgh, Pennsylvania

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Pacific Coast Distributors: Columbia Steel Company, Russ Building, San Francisco — *Export Distributors:* United States Steel Products Company, New York

EGYPT

ITALY

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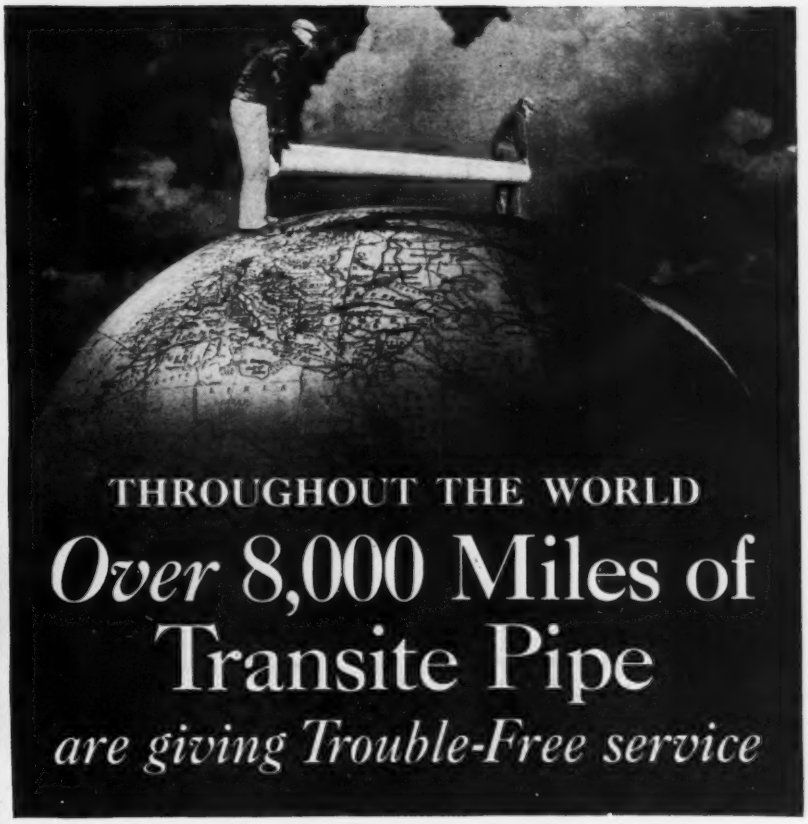
UNITED STATES



THROUGHOUT THE WORLD

Over 8,000 Miles of Transite Pipe

are giving Trouble-Free service

Installations in every major country (many over 20 years old) have proved immune to tuberculation, soil corrosion, electrolysis

ASBESTOS CEMENT PIPE* was first manufactured in Europe more than 20 years ago. Today a network of some 8,000 miles traverses the principal countries of the world.

In the United States and Canada, asbestos cement pipe, manufactured by Johns-Manville under the name "Transite," has achieved wide acceptance among water works engineers.

Wherever used—for all types of water, in all kinds of soil—asbestos cement pipe has rendered trouble-proof, maintenance-free service.

Composed of asbestos fibre and Portland cement, combined under pressure into a homogeneous structure of extreme density, Transite Pipe is virtually chemically inert and remarkably resistant to destructive agencies.

It eliminates all possibility of tuberculation and electrolysis. It provides exceptional resistance to soil corrosion. And assures permanent freedom from excessive pumping costs, reduced pressure, constant cleaning expense, shutdown, and costly renewals.

Send for New Brochure

Space prevents a full description of Transite's distinctive characteristics. Send for the new brochure which discusses in detail its light weight, its ease and economy of installation; and describes the Simplex Coupling for underground Transite lines, a joint which is permanently flexible, and absolutely bottle-tight even under severe vibration. Mail the coupon.

*Asbestos cement pipe is known throughout the world by various trade names. In the United States it is made and marketed solely by Johns-Manville under the name "Transite."

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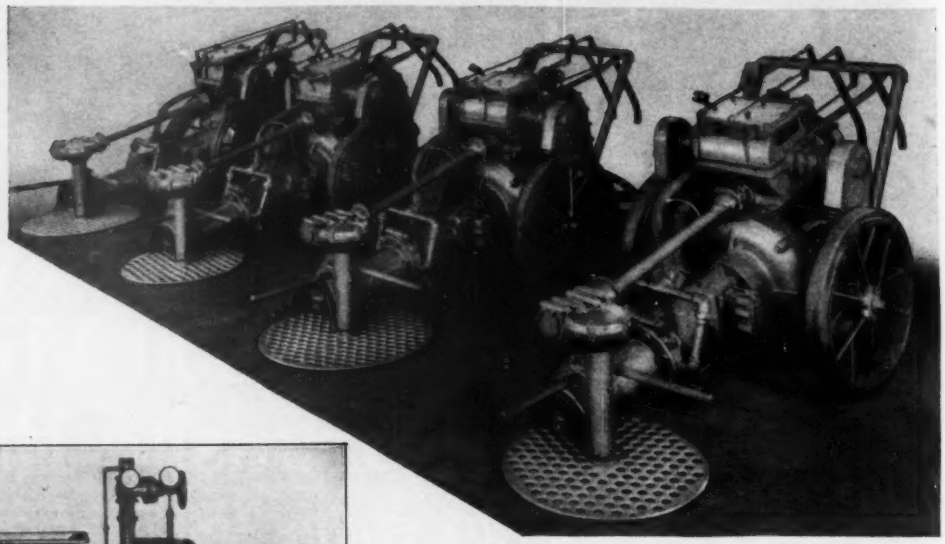

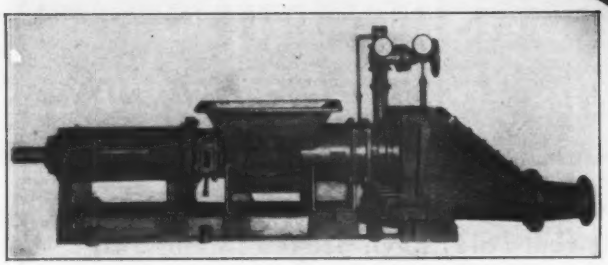

Four of the five new portable Fuller-Kinyon pumps for T. V. A. Three will unload barges and two will unload box cars. Cement for the lock at Wheeler Dam was unloaded from barges by a similar pump.

One of two stationary pumps of the type shown at the left will convey from the truck unloading station to the mixing plant at Norris Dam.

WHEELER DAM

Four floating mixing plants will be supplied with cement by three portable Fuller-Kinyon Pumps. Advantage has been taken of the ability of the portable pumps to convey over long distances to make the plant arrangements unusually convenient and economical in handling all materials. At each mixer barge, aggregate barges will tie up at each side. The cement barges will be beyond the aggregate barges to avoid interference with the unloading of aggregates and movement of barges. The cement pipe-lines will cross the decks and will be provided with flexible sections to adapt the systems to changing barge levels.

NORRIS DAM

Twelve box cars can be unloaded without shifting a car. The unloading platform between sidings will accommodate six cars on a side. Two portable pumps, of the same type as those used for unloading barges at Wheeler Dam, will move from car to car. The cement will be delivered to a truck-loading bin. At the dam, the trucks will dump into a hopper, from which one of two "Type H" stationary pumps will convey direct to the mixing plant or through a branch line to storage. Stored cement will be spouted to the pump hopper for delivery to the mixer plant.

THE LOCK

Bulk cement for the lock at Wheeler Dam was unloaded from barges by a portable Fuller-Kinyon Pump.

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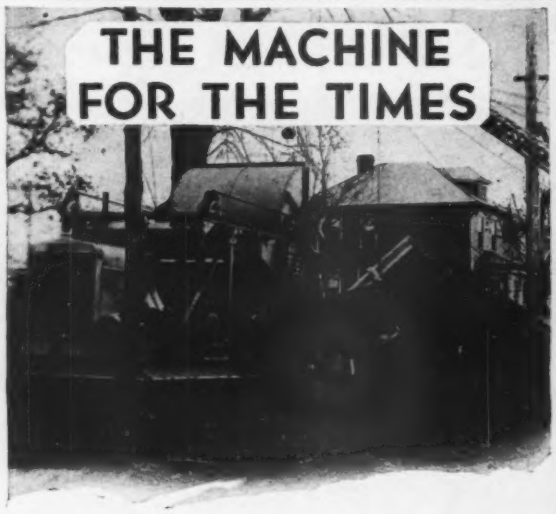

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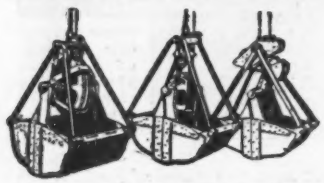

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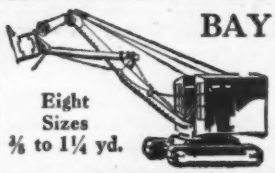

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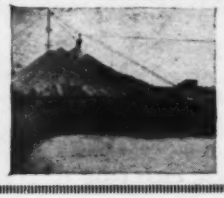

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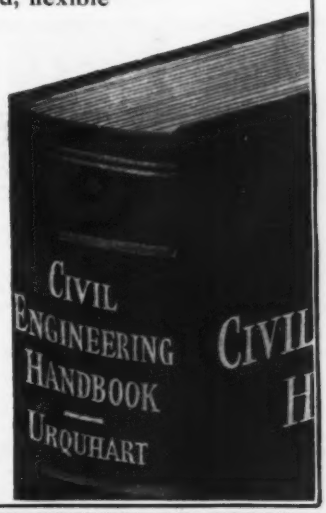

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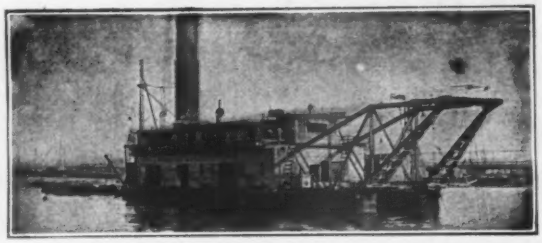

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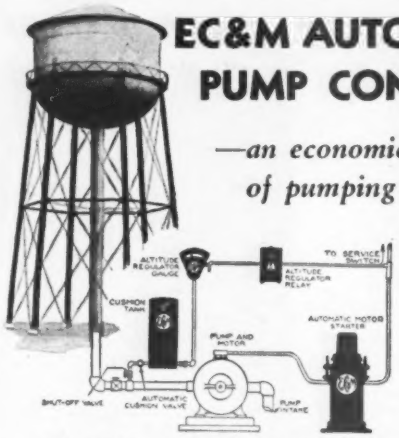

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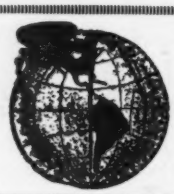

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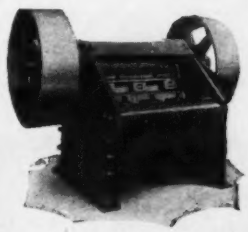

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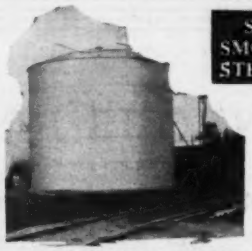

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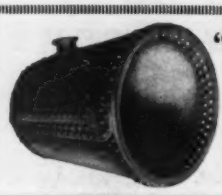

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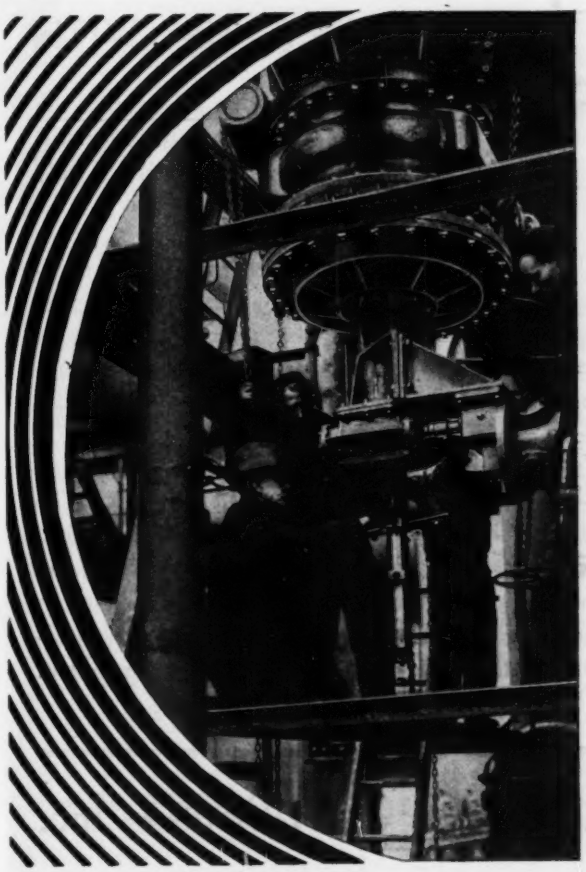

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OFFICIAL PROPOSALS

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Rate:
40 Cents a Line an Insertion
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Plans and Specifications for inspection by distant bidders may be filed at any of the Engineering News-Record offices without charge.

THESE ARE OFFICIAL NOTICES THAT BIDS ARE WANTED FROM BIDDERS EVERYWHERE

E. N.-R.

U. S. Government

UNITED STATES DEPARTMENT OF AGRICULTURE, Bureau of Public Roads, Washington, D. C., June 22, 1934.—Sealed bids will be received at the office of the Acting Superintendent, Morristown National Historical Park, Morris County, New Jersey, until 10 o'clock a.m., E.S.T., July 12, 1934, for Project 2A-1, which includes the *improvement of Jockey Hollow Road and a portion of Sugar Loaf Road in the Morristown National Historical Park:* 1.72 miles in length, involving approximately 9,100 lin.ft. underdrain; 4,400 cu.yd. gravel surfacing; 100 sq.yd. grouted rubble gutter; laying 650 lin.ft. 18" C.M. pipe; and furnishing 1 tractor grader outfit by the day. Where plans and specifications are requested, a deposit of $10.00 will be required to insure their return within 15 days after opening of bids. Checks should be made payable to the U. S. Department of Agriculture. Plans, specifications and proposal forms may be obtained at the office of the Bureau of Public Roads, Room 419 Winder Buildings, 17th and F Streets, N.W., Washington, D. C., or at the office of the Acting Superintendent, Morristown, New Jersey. H. J. SPELMAN, Principal Highway Engineer. (267)

TREASURY DEPARTMENT, Procurement Division, Public Works Branch, Washington, D. C.—Sealed bids in duplicate will be publicly opened in this office at 3 p.m., July 17, 1934, for furnishing all labor and materials and performing all work for the *construction of the U. S. post office at North Wilkesboro, N. C.* Attention is directed to the special conditions of bidding set forth in the specifications, and bulletin No. 51 of the Federal Emergency Administration of Public Works and Executive Order No. 6646. Drawings and specifications, not exceeding three sets, may be obtained at this office in the discretion of the assistant director of Procurement, Public Works Branch, by any general contractor, provided a deposit of $15 is made for each set to assure its prompt return. One set will be furnished builders' exchanges, chambers of commerce or other organizations who will guarantee to make them available for any subcontractor or material firm interested, and to quantity surveyors, provided a deposit of $15 is made to assure its prompt return. Checks offered as deposits must be made payable to the order of the Treasurer of the United States. Cash deposits will not be accepted. W. E. REYNOLDS, Assistant Director of Procurement, Public Works Branch. (268)

SEALED BIDS, indorsed "Bids for crane, Specification No. 7641," will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until 11 o'clock a.m., Aug. 15, 1934 and then and there publicly opened, for *reerection of a 200-ton hammer-head crane at the Navy Yard, Pearl Harbor, T. H.* The Government reserves the right to require, prior to the award of the contract, a statement of facts in detail of the business and technical organization and plant of the bidder available for the contemplated work, including financial resources for such part of the work as is not provided for by the stipulation in article 16 of the Contract to be used, and experience of organization in construction of comparable work. The Government reserves the right to reject any bid respecting which the facts as to business and technical organization, financial resources, plant, or experience, compared with the project bid upon, justify such rejection. Specification No. 7641 and accompanying drawings may be obtained on application to the Bureau or to the Commandant, Fourteenth Naval District, Navy Yard, Pearl Harbor, T. H., or to the Commandant, Twelfth Naval District, 100 Harrison Street, San Francisco, Calif. Deposit of a check or postal money order for $10, payable to the Chief of the Bureau of Yards and Docks, is required as security for the safe return of the drawings and specification. NORMAN M. SMITH, Chief of Bureau, June 7, 1934. (2610)

U. S. Government

OFFICIAL PROPOSALS

Bids: July 16.

Bridge

STATE OF NEW JERSEY
STATE HIGHWAY COMMISSION
TRENTON

Notice is hereby given that sealed bids will be received by the State Highway Commission for:

R. R. BRIDGE OVER RT. 48, SEC. 27, at PLEASANTVILLE

Construction of a bridge to carry the tracks of the Pennsylvania Reading Seashore Lines across Route No. 48, Section No. 27, at Pleasantville, Atlantic County. The structure will consist of two spans half-through plate girders with a total length of 120 feet and a width of about 30 feet. The principal items of construction are:

ESTIMATED:

274 cu.yds. foundation excavation.
776 cu.yds. concrete.
268,000 lbs. structural steel.
40,000 lbs. reinforcement steel.

Bids for the above will be received at the office of the State Highway Commission, State House Annex, Trenton, N. J., on Monday, July 16, 1934, at eleven o'clock, Standard Time (twelve o'clock Noon, DAYLIGHT SAVING TIME) and will be opened and read immediately thereafter.

The receipt and opening of bids is subject to the proper qualification of the bidder in accordance with the provisions of the prequalification law and the regulations adopted by the State Highway Commission. Bidders must submit a revised financial statement and statement of plan and equipment with their bid.

Drawings, specifications and form of bid, contract and bond for the proposed work are on file in the office of the State Highway Department, Trenton, N. J., and may be inspected by prospective bidders during office hours. Plans will be furnished on a deposit of Ten Dollars ($10.00) for each set of plans upon application to the State Highway Department, Room 102, State House Annex, Trenton, N. J. Bids must be made on the standard proposal forms in the manner designated in the standard specifications and must be enclosed in sealed special addressed envelopes bearing the name and address of the bidder and work bid upon on the outside, and must be accompanied by a certified check drawn to the order of the Treasurer of the State of New Jersey for not less than ten per cent (10%) of the amount of the bid, provided that the said certified check shall not be less than $500.00 nor more than $20,000.00 and must be delivered at the above place on or before the hour named. Copies of the standard proposal form and special addressed envelopes will be furnished on application. Bids not enclosed in special addressed envelopes will be considered informal and will not be opened. The right is reserved to reject any or all bids.

By order of the State Highway Commission.

A. LEE GROVER,
Chief Clerk.

OFFICIAL PROPOSALS

Bids: July 9.

Bridges

STATE OF NEW JERSEY
STATE HIGHWAY COMMISSION
TRENTON

NOTICE IS HEREBY GIVEN that sealed bids will be received by the State Highway Commission for:

BRIDGES OVER C.R.R. and L.V.R.R.—RT. 29, SEC. 11

Construction of two bridges on Route No. 29, Section No. 11, near Three Bridges, Hunterdon County. One bridge will cross the right of way of the Central Railroad of New Jersey consisting of three spans and having a total length of 120 feet and a width of 40 feet. The second bridge will cross the right of way of the Lehigh Valley Railroad consisting of three spans and having a total length of 172 feet and a width of 40 feet. The principal items of construction are:
Estimated:

500 cu.yds. foundation excavation
1400 cu.yds. concrete
205000 lbs. reinforcement steel
450000 lbs. structural steel
21000 sq.ft. cement mortar protection

Bids for the above will be received at the office of the State Highway Commission, State House Annex, Trenton, N. J., on Monday, July 9th, 1934, at eleven o'clock Standard Time (twelve o'clock Noon, DAYLIGHT SAVING TIME) and will be opened and read immediately thereafter.

The receipt and opening of bids is subject to the proper qualification of the bidder in accordance with the provisions of the present prequalification law and the regulations adopted by the State Highway Commission. Bidders must submit a revised financial statement and statement of plan and equipment with their bid.

Drawings, specifications and form of bid, contract and bond for the proposed work are on file in the office of the State Highway Department, Trenton, N. J., and may be inspected by prospective bidders during office hours. Plans will be furnished on a deposit of Ten Dollars ($10.00) for each set of plans upon application to the State Highway Department, Room 102, State House Annex, Trenton, N. J. Bids must be made on the standard proposal forms in the manner designated in the standard specifications and must be enclosed in sealed special addressed envelopes bearing the name and address of the bidder and work bid upon on the outside, and must be accompanied by a certified check drawn to the order of the Treasurer of the State of New Jersey for not less than ten per cent (10%) of the amount of the bid, provided that the said certified check shall not be less than $500.00 nor more than $20,000.00 and must be delivered at the above place on or before the hour named. Copies of the standard proposal form and special addressed envelopes will be furnished on application. Bids not enclosed in special addressed envelopes will be considered informal and will not be opened. The right is reserved to reject any or all bids.

By order of the State Highway Commission.

A. LEE GROVER,
Chief Clerk.

OFFICIAL PROPOSALS

Bids: July 17.

Electric Distribution System

FOR

CITY OF KNOXVILLE, TENNESSEE

P.W.A. DOCKET NO. 3289

Sealed proposals will be received at the office of W. W. Mynatt, City Manager, Knoxville, Tennessee, on or before 10 a.m. of July 17, 1934, for furnishing the necessary labor and materials for a complete electric distribution system for the City of Knoxville, Tennessee, under four contracts.

CONTRACT NO. 1—Overhead System (District 2), Certified Check or Bidders Bond $15,000

CONTRACT No. 2—Meters, Certified Check or Bidders Bond..... 10,000

CONTRACT NO. 3—Transformers, Certified Check or Bidders Bond 12,500

CONTRACT NO. 4 — Substation Equipment, Certified Check or Bidders Bond 10,000

All material and labor must be in accordance with plans and specifications, copies of which are on file in the office of the Director of Public Service, Knoxville, Tennessee, and with the Burns & McDonnell Engineering Company, Kansas City, Missouri.

Bids must be accompanied by a certified check or a bidders bond in the amount called for under each contract, as a guaranty that if the bid is accepted a contract will be entered into and its performance properly secured within ten (10) days after awarding of the contract.

Plans and specifications desired for the purpose of bidding may be obtained from the Consulting Engineer by making a deposit of $20.00 for Contract 1, and specifications for contracts 2, 3 and 4 will be furnished upon request. One half of the deposit will be refunded upon return of the plans and specifications within ten (10) days after date of letting.

This is a non-federal project financed by a loan and grant by the Federal Emergency Administration of Public Works and bidders must conform to all rules and regulations governing such work.

All employees directly employed on this work shall be paid just and reasonable wages which shall in no event be less than the minimum hourly rates for skilled and unskilled labor prescribed by the Administrator, i.e., skilled labor, $1.10 per hour; unskilled labor, $0.45 per hour.

The local employment agency designated by the United States Employment Service is known as the National Re-employment Service with offices at 208 New Federal Building, Knoxville, Tennessee.

The right is reserved to reject any and all bids and to waive informalities.

All general contractors must have complied with all requirements of Chapter No. 70, Public Acts of 1931 of the General Assembly of the State of Tennessee, Section 1, which is as follows: "SECTION 1. Be it enacted by the General Assembly of the State of Tennessee, That in order to safeguard life, health and property, and to promote public welfare by requiring that only properly qualified persons shall engage in general contracting, any person, firm or corporation engaged in general contracting, in this State shall be required to submit evidence that he is qualified to engage in general contracting, and shall be licensed as hereinafter provided; and from ninety (90) days after the passage of this Act, it shall be unlawful for any person, firm or corporation to engage in or offer to engage in general contracting in this State, unless such person, firm or corporation has been duly licensed under the provisions of this Act, as hereinafter provided. This Act requires a general contractor to be licensed by the State Board for Licensing General Contractors, where the cost of the complete work exceeds $10,000.00, before his bid can be considered."

ALL BIDDERS ON CONTRACT NO. 1 MUST THEREFORE BE LICENSED.

W. W. MYNATT, City Manager,
Knoxville, Tennessee.

BURNS & McDONNELL,
Engineering Company,
107 West Linwood Boulevard,
Kansas City, Missouri,
Consulting Engineers.

Notice to Advertisers!

Because of the Holiday, Independence Day, the *"Searchlight"* pages of the July 5th issue of

ENGINEERING NEWS-RECORD

will close in advance of the regular schedule.

Advertisers will please cooperate with us by sending new advertisements or changes of copy early.

FINAL CLOSING TIME
Official Proposals:
10 A.M., Tuesday, July 3rd

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(*Circulation over 22,500 weekly*)

prints more than twice as many announcements advertising contracts to be let as appear in any other publication

Practically every form of public work and the furnishing of material and supplies are printed in the Official Proposal Columns of *Engineering News-Record*. They include calls for bids on:

Boilers
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Paving
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Sewage Disposal Plants
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Street Improvements
Street Lighting Systems
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THIS wide use of *Engineering News-Record's* Official Proposal Columns and the rapidly growing recognition of this paper's value as an advertising medium is due to RESULTS—keen competition, lower bids, better work—and savings.

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The Dominant Proposal Medium

U. S. Government

TREASURY DEPARTMENT, Procurement Division, Public Works Branch, Washington, D. C.—Sealed bids in duplicate, subject to the conditions contained herein, will be publicly opened in this office at 3 p.m., July 13, 1934, for furnishing all labor and materials and performing all work for *construction of the U. S. post office at Detroit Lakes, Minn.* Attention is directed to the special conditions of bidding set forth in the specifications, and bulletin No. 51 of the Federal Emergency Administration of Public Works and Executive Order No. 6646. Drawings and Specifications, not exceeding three sets, may be obtained at this office in the discretion of the assistant director of Procurement, Public Works Branch, by any general contractor, provided a deposit of $15.00 is made for each set to assure its prompt return. One set will be furnished builders' exchanges, chambers of commerce or other organizations who will guarantee to make them available for any subcontractor or material firm interested, and to quantity surveyors, provided a deposit of $15.00 is made to assure its prompt return. Checks offered as deposits must be made payable to the order of the Treasurer of the United States. Cash deposits will not be accepted. W. E. REYNOLDS, Assistant Director of Procurement, Public Works Branch. (257)

U. S. ENGINEER OFFICE, Rock Island, Illinois.—Sealed bids, in duplicate, will be received at this office until 11:00 a.m., July 3, 1934, and then publicly opened, for supplying one plate and 300 sheets each, in three colors, of 35 *separate maps*, size 27"x40". Further information on application. (255)

U. S. ENGR. OFFICE, Providence, R. I.—Sealed bids will be received here until 2 p.m., d.s.t., July 6, 1934, for *removing* approximately 344 cu.yd. of *rock* and 90 cu.yds. of material other than rock in entrance channel, *New Haven Harbor, Conn.* (258)

WAR DEPARTMENT, U. S. ENGINEER OFFICE, 2nd District, 39 Whitehall St., New York City. Sealed bids will be received until 11 A.M., E.D.S.T., June 29, 1934, and then publicly opened, for furnishing all labor and materials and performing all work for *dredging* approximately 394,500 cubic yards of material in *Newark Bay and Hackensack River, N. J.* (2414)

TREASURY DEPARTMENT, Procurement Division, Public Works Branch, Washington, D. C.—Sealed bids in duplicate will be publicly opened in this office at 3 p.m., July 12, 1934, for furnishing all labor and materials and performing all work for the *construction of medical officers' double house and garage at the U. S. Marine Hospital, Boston, Mass.* Attention is directed to the special conditions of bidding set forth in the specifications, and bulletin No. 51 of the Federal Emergency Administration of Public Works and Executive Order No. 6646. Drawings and specifications, not exceeding 3 sets, may be obtained at this office in the discretion of the Assistant Director of Procurement, Public Works Branch, by any general contractor, provided a deposit of $15 is made for each set to assure its prompt return. One set will be furnished builders' exchanges, chambers of commerce or other organizations who will guarantee to make them available for any subcontractor or material firm interested, and to quantity surveyors, provided a deposit of $15 is made to assure its prompt return. Checks offered as deposits must be made payable to the order of the Treasurer of the United States. Cash deposits will not be accepted. W. E. REYNOLDS, Assistant Director of Procurement, Public Works Branch. (266)

TENNESSEE VALLEY AUTHORITY, Knoxville, Tennessee.—Sealed bids, in duplicate, will be received until 10 a.m., Central Standard Time, Friday, July 20, 1934, and then publicly opened, for *furnishing, fabricating, and delivering eight* (8) *sets of* 5'8"x10'0", *high-pressure slide gates*, together with frames, hoists, automatic and semi-automatic gate hangers, and conduit linings, bolts, gaskets, etc., for installation in the sluice outlet works at Norris Dam, Tennessee. Bid forms, specifications, and drawings available at the above office on and after June 29, 1934. C. H. GARITY, Director of Purchases. (269)

OFFICIAL PROPOSALS

Bids: July 3.

Sanitary Sewer System

CHRISTIANSBURG, VIRGINIA.

Sealed proposals will be received by the Town of Christiansburg, Montgomery County, Virginia, at the office of the Town Clerk, R. L. Miller, until two o'clock p.m. Eastern Standard Time, July 3, 1934, to be opened immediately thereafter, for the furnishing of labor, material and equipment and the construction of a sanitary sewer system, consisting of mains and accessories in and for the Town of Christiansburg, Virginia. The work embraces approximately the following:

50,663—Lin.ft. 6", 8", 10", 12", 15" and 20" Sewer Pipe.
300—Lin.ft. 8", 10" and 12" Cast Iron Pipe.
643—8x6" Wye Branches.
98—10x6" Wye Branches.
160—Manholes.
2,500—Cu.yds. Rock Excavation.
Settling Tank.
Sludge Drying Bed.
3,250—Lin.ft. 1½" Galvanized Pipe.
Miscellaneous items and appurtenances.

Bids are asked for and considered only on the basis of furnishing and installing material and equipment complete as a General Contractor's job.

Specifications may be seen at the office of the Town Clerk, at Christiansburg, Va., or the office of the Engineers, and copies may be obtained by depositing $5.00, which amount will be returned to bona fide bidders, but not to those who do not bid. Plans may be seen and obtained at either of the above places.

Contracts will not be awarded until bids have been examined and passed upon by the State Engineer, State Advisory Board of the Public Works Administration, with the further provision that contract be conditioned upon final consummation of the bond purchase contract by the Federal Emergency Administration of Public Works and conform to its requirements.

The Town has a right to reject any or all bids.

TOWN OF CHRISTIANSBURG, VIRGINIA.
By B. L. HAYMAKER, Mayor.
R. L. MILLER, Clerk.
J. B. McCRARY ENGINEERING CORP'N., Engineers,
Atlanta, Georgia.

Bids: July 18.

Incinerator

P.W.A. PROJECT
No. 1794

Houma, La.

By virtue of the authority vested in me by law and Ordinance No. 1287 of the Mayor and Board of Aldermen of the City of Houma, Louisiana, adopted on the 13th day of June 1934, I hereby give notice that sealed bids will be received by the Mayor and Board of Aldermen of the City of Houma until the 18th day of July 1934 at 7:30 o'clock P.M. at the office of the Clerk of the City, in the City Hall at Houma for the construction of a Refuse Incinerator of not less than 24 tons per 24 hours capacity.

No bid will be considered unless accompanied by signed "Certificate of Compliance with NRA in Connection with P.W.A. Projects" U. S. Government Form No. P.W.A. 61 (Revised March 1934).

All proposals must be based upon compliance with the provisions of "Construction Regulations" of the Federal Emergency Administration of Public Works.

Each bid must be accompanied by a certified check in an amount of 5 per cent of the gross amount bid, or bidders bond in an amount of 10 per cent of the gross amount bid; but in no case shall the check or bid bond be less than Seven Hundred Fifty Dollars ($750.00) as evidence of good faith and to guarantee the signing of the contract and making bond if the contract is awarded to bidder. In the event that bid bond is furnished, it should follow Form No. 24, Standard Government Form of Bid Bond.

The right is reserved to reject any or all bids, to waive any and all formalities, and to accept any bid or bids which, in the opinion of the awarding authority, appear to the best interests of the City of Houma, subject to the judgement and approval of the State Engineer P. W. A.

Specifications, Bid Forms and Contract Forms are on file at the office of the Clerk of the City of Houma, Louisiana, or at the office of the Consulting Engineers, J. L. Porter, and Earl Engineering Co., 2002 American Bank Building, New Orleans, Louisiana.

OFFICIAL PROPOSALS

Bids: July 9.

State Highway Work

STATE OF NEW JERSEY
STATE HIGHWAY COMMISSION
TRENTON

NOTICE IS HEREBY GIVEN that sealed bids will be received by the State Highway Commission for:

ROUTE NO. 25, SECTION NO. 12

Construction of Route No. 25, Section No. 12, Bridgeboro to Cinnaminson Road, Burlington County, Length 4.000 miles.
Estimated:
72,012 cu.yds. unclassified excavation
37,438 cu.yds. borrow
50,998 sq.yds. 9" rein.conc. pavement
361 sq.yds. 18" rein.conc. bridge approach slab
Two small span stream bridge extensions.

Bids for the above will be received at the office of the State Highway Commission, State House Annex, Trenton, N. J. on Monday, July 9th, 1934, at eleven o'clock, 11:00 A.M. Standard Time (twelve o'clock, 12:00 Noon, DAYLIGHT SAVING TIME) and will be opened and read immediately thereafter.

The receipt and opening of bids is subject to the proper qualification of the bidder in accordance with the provisions of the prequalification law and the regulations adopted by the State Highway Commission. Bidders must submit a revised financial statement and statement of plan and equipment with their bid.

NOTE: The proposed work is a "United States Public Works Project" under the provisions of Title II, Section 204, of the National Industrial Recovery Act approved June 16, 1933, and is to be performed in accordance with the Special Provisions and Requirements of the United States Department of Agriculture, Bureau of Public Roads, as outlined in the Instructions to Bidders to be made a part of the specifications and contract, which provisions require the employment of labor from lists furnished by the National Re-employment Service, 55 Main Street, Mount Holly, N. J., preference in employment to be given to qualified ex-service men with dependents. The attention of bidders is directed to the special provisions covering subletting or assigning the contract and to the use of Domestic Materials. The minimum wage paid to all skilled labor employed on this contract shall be 65c per hour. The minimum wage paid to all unskilled labor employed on this contract shall be 40c per hour.

A certificate of compliance on the prescribed form which will be furnished for that purpose shall be signed and submitted by all bidders in accordance with Executive Order No. 6646, issued by the President on March 14, 1934. Only bids accompanied by such certificates shall be considered or accepted. The contractor to whom award is made shall require subcontractors and dealers furnishing equipment, materials, and supplies to sign similar certificates before making awards to or purchases from such subcontractors or dealers, copies of which shall be furnished to the contracting officer.

Drawings, specifications and form of bid, contract and bond for the proposed work are on file in the office of the State Highway Department, Trenton, N. J. and may be inspected by prospective bidders during office hours. Plans will be furnished on a deposit of Ten Dollars ($10.00) for each set of plans upon application to the State Highway Department, Room 102, State House Annex, Trenton, N. J. Bids must be made on the standard proposal forms in the manner designated in the 1933 standard State Highway specifications and must be enclosed in sealed special addressed envelopes bearing the name and address of the bidder and work bid upon on the outside, and must be accompanied by a certified check drawn to the order of the Treasurer of the State of New Jersey for not less than ten per cent (10%) of the amount of the bid, provided that the said certified check shall not be less than $500.00 nor more than $20,000.00 and must be delivered at the above place on or before the hour named. Copies of the standard proposal forms and special addressed envelope will be furnished on application. Bids not enclosed in special addressed envelopes will be considered informal and will not be opened. The right is reserved to reject any or all bids.

By order of the State Highway Commission.

A. LEE GROVER,
Chief Clerk.

U. S. Government

UNITED STATES DEPARTMENT OF THE INTERIOR, Bureau of Reclamation (Federal Emergency Administration of Public Works Project), Washington, D. C., June 16, 1934.—Sealed bids (Specifications No. 578) will be received at the office of the Bureau of Reclamation, Fairfield, Montana, until 10 a.m., July 12, 1934, and will at that hour be opened for furnishing labor and materials and performing all work for the *construction of earthwork and structures, Mill Coulee Canal and laterals*, Greenfields division, Sun River project, Montana. The work is located near Fairfield and Ashuelot, Montana. The principal items of work and the estimated quantities involved are as follows: 79,000 cubic yards of all classes of excavation for laterals; 3,700 cubic yards of all classes of excavation for structures; 8,100 station cubic yards of overhaul; 2,600 cubic yards of back fill; 1,240 cubic yards of concrete in structures; 450 square yards of grouted paving; 200 square yards of dry rock paving; placing 96,000 pounds of reinforcement bars; laying 640 linear feet of 18-inch and 24-inch diameter concrete pipe; laying 1,200 linear feet of 4-inch and 6-inch drain pipe; laying 504 linear feet of 20-inch to 30-inch corrugated metal pipe; and installing 14,800 pounds of gates and miscellaneous metal work. This invitation for bids does not cover the purchase of materials which are to be furnished by the Government. Materials to be furnished by the contractor and those furnished by the Government are described in the specifications which will be a part of the contract. The work must be completed in 220 days. No charge to prospective bidders for copies of plans and specifications; to others $2.00, not returnable. For particulars, address the Bureau of Reclamation, Fairfield, Montana; Denver, Colorado; or Washington, D. C. M. A. SCHNURR, Acting Commissioner. (264)

U. S. Government

TENNESSEE VALLEY AUTHORITY, KNOXVILLE, TENNESSEE. Sealed bids in duplicate will be received until 10 A.M., Central Standard Time, Monday, July 9, 1934, and then publicly opened, for six (6) 3333 KVA, single phase, *self cooled power transformers*, to step down from 115,000 volts Y to 13,200 volts Y, with a 2300 volt tertiary winding of 833 KVA capacity for service to municipal distribution system of the city of Knoxville, Tennessee. Information, specifications, and bid forms available at above office on and after June 25, 1934. C. H. Garity, Director of Purchases. (261)

PROPOSAL FOR BRIDGE CONSTRUCTION, U. S. Engineer Office, Charleston, S. C.—Sealed proposals will be received here until 12 o'clock noon, July 12, 1934, and then opened, for the construction of a *swing span highway bridge* with road approaches and detour across the Intracoastal Waterway, three miles south of Little River, S. C. A deposit of $10.00 will be required for plans. Further information on application. (251)

U. S. ENGINEER OFFICE, Rock Island, Illinois.—Sealed bids, in duplicate, will be received at this office until 2:00 p.m., July 10, 1934, and then publicly opened, for furnishing (Item 1) all plant, labor and materials and performing all work required for approximately 410,000 cubic yards of rock excavation at wing dams 9 and 39; (Item 2) approximately 20,000 cubic yards of rock excavation at Moline Pool Dam, and (Item 3) for furnishing and erecting 16 concrete block channel markers on *Moline Pool Dam*, all in the vicinity of Moline, Illinois. Further information on application. (248)

U. S. Government

WAR DEPARTMENT, Office of Constructing Quartermaster, Maxwell Field, Alabama.—Sealed proposals will be received at this office until 10:00 a.m., C.S.T., July 6, 1934, and then publicly opened for *construction of Roads, Driveways, Sidewalks, Culverts and Storm Sewers for Officers' Area at Maxwell Field, Alabama*. Prospective bidders may obtain plans and specifications upon deposit of certified check in amount of $5.00, made payable to the Treasurer of the United States. (263)

WAR DEPARTMENT: United States Engineer Office, Galveston, Texas.—Sealed bids will be received until 12:00 M. July 2, 1934, and then publicly opened for furnishing all labor and material and performing all work for *repairing the North and South Jetties at Port Aransas, Texas*. Further information on application. (245)

U. S. ENGINEER OFFICE, P. O. Box 59, Louisville, Ky.—Sealed bids will be received until 2:00 p.m. (C.S.T.), July 24, 1934, and then publicly opened, for furnishing *one 1,600 hp. Diesel engine for dredge pump*. Further information on application. (262)

SEALED PROPOSALS will be opened by the Supt. of Lighthouses, 11th Dist., 3760 E. Jefferson Ave., Detroit, Mich., 2 p.m., July 13, 1934, for *two to ten helical bar lanterns*, 6'0" diameter. Information upon application. (265)

YOU GET national competition on your request for bids in the Official Proposal Columns of

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GENERAL superintendent, 20 years on reinforced concrete and steel construction, now handling bridge department for general contractor, C.E. graduate, sound estimator, desires connection with contractor in broader field. First class references, location immaterial. PW-683, Engineering News-Record, 330 West 42d St., New York City.

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BUILDING contractor's assistant. Thoroughly experienced estimator, engineer and superintendent, 13 years' experience in office and field on all types buildings. PW-677, Engineering News-Record, 520 No. Michigan Ave., Chicago, Ill.

CONTRACTOR'S engineer, graduate, 22 years' wide experience building and general construction, including estimating, purchasing, superintending, seeks connection. PW-668, Engineering News-Record, 330 West 42d St., New York City.

DRAFTSMAN, competent, active, 20 years' experience, mechanical, electrical, structural, ships, topographic. Desire work, any grade, anywhere. PWB, 620 Main St., So. Portland, Maine.

DOES your town require a practical and inexpensive system of sewage disposal? Expert with twenty years' practical experience, specializing in sewer systems, will design and construct an efficient and adequate storm or sanitary sewer system, together with a suitable disposal plant. Permanent construction with minimum expense. PW-664, Engineering News-Record, 330 West 42d St., New York City.

GENERAL FOREMAN, five years construction foreman, eleven years excavation, sheeting, foundation, concrete bridges, retaining walls, general concrete construction. Any location. PW-674, Engineering News-Record, 330 West 42d St., New York City.

LAWYER-engineer-superintendent. Graduate civil engineer and lawyer. 12 years' experience construction work both in field and as executive. Experienced in costs; estimating; plant, floating and land; representing contractor in negotiations. This construction experience and legal training should be useful. Interview solicited. PW-676, Engineering News-Record, 1500 Commercial Trust Bldg., Phila.

POSITIONS WANTED

WATER WORKS engineer-manager, 20 years' experience in design construction, operation and management. Available July 15th. PW-678, Engineering News-Record, 330 West 42d St., New York City.

GENERAL foreman, 10 years' experience construction and estimating. References. Go anywhere. PW-686, Engineering News-Record, 330 West 42d St., New York City.

(Continued on opposite page)

Notice to Advertisers!

Because of the holiday, Independence Day, the *"Searchlight"* pages of the July 5th issue of

ENGINEERING NEWS-RECORD

will close in advance of the regular schedule.

Advertisers will please cooperate with us by sending new advertisements or changes of copy early.

FINAL CLOSING TIME

Display and Undisplayed Ads:
4 P.M., Friday, June 29th

Official Proposals:
10 A.M., Tuesday, July 3rd

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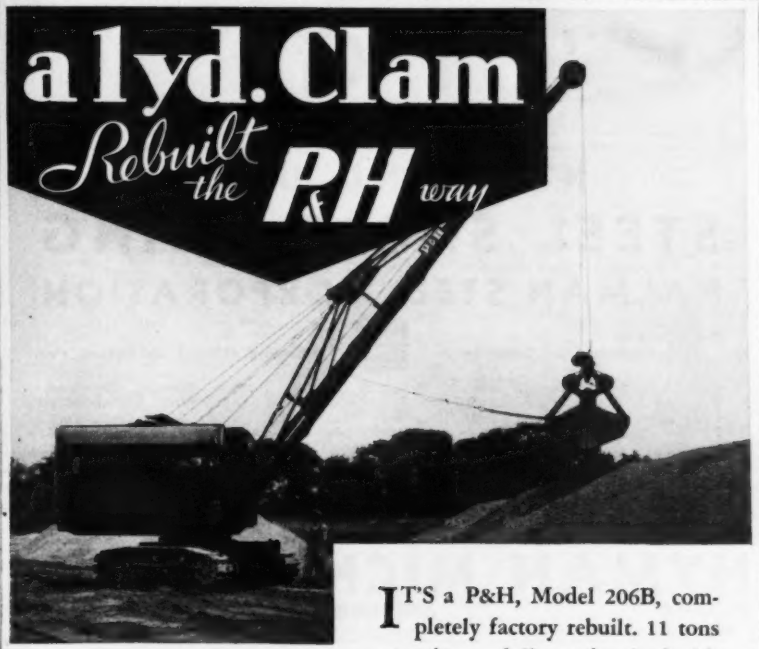

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(Continued from opposite page)

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Drafting Machine
Universal, Mid-Anchor, standard protractor, Size 28. Fredrick, 816 2nd Ave., New York City. Mu 4-1946.

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WAR DEPARTMENT, U. S. Engineer Office, Cincinnati, O. Sealed proposals will be received at this office until 11 o'clock A.M., Eastern Standard Time, July 10, 1934, and then publicly opened for the *sale of the Suction Dredge "Portland," the Diesel-Electric Towboat "Kanawha,"* Needle Flat No. 192 and Needle Flat No. 31, all in accordance with the specifications, copies of which may be had at this office. (252)

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1—P&H Model 600 with 50-ft. boom; 1-yd. dragline or clam; Serial No. 2550.
1—Link-Belt gasoline, Model K-1; 10-ton; 50-ft. boom; shop No. K-1024.
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55—Electric ranging from 20 hp. up to 125 hp., consisting of triple-drum, double-drum and single-drum, with A.C. or D.C. mtrs., some with attached swingers. Following makes: American, Clyde, Lambert, Lidgerwood, Thomas.
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Turntables
American Bridge Co.

Underpinning
Spencer, White & Prentis, Inc.

Unloaders, Car and Wagon
Wellman Engineering Co.

Valves
Smith Mfg. Co., A. P.
Wellman Engineering Co.

Valves, Control Electric
Cutler-Hammer, Inc.

Vibrators, Concrete
Electric Tamper & Equip. Co.
Munsell Concrete Vibrators

Wagons and Trailers, Dump
Adams Co., J. D.
Allis-Chalmers Mfg. Co.
Austin-Western Rd. Mchry. Co.
Wellman Engineering Co.

Welding & Cutting Apparatus
Linde Air Products Co.

Welding Gas
Linde Air Products Co.

Welding Rods & Wire
American Steel & Wire Co.
Linde Air Products Co.

Wellpoint Systems
Moretrench Corp.

Wires & Cables, Electrical
American Steel & Wire Co.

Wood Pipe
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AN advertising agency recently checked the advertisements in a number of leading business publications and found that 47% of the advertising in *Engineering News-Record* was devoted to new and improved equipment and materials.

Future construction estimates will be planned with an eye open to the economies of these new products. It will pay every engineer and contractor to familiarize himself with the products advertised in this journal before writing specifications or bidding on new projects.

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CB·SECTION STEEL BEARING PILES

show those from Missouri"

Penetration through 28 to 32 feet of cemented sand and gravel . . . that was the job so successfully accomplished by CB section steel bearing piles in the construction of the bridge over the Black River at Hendrickson, Butler County, MISSOURI. The illustration shows one of eight pile clusters of 10" CB 49# sections partially driven. Note the perfect alignment of the piles and the simplicity of swinging leads and driving rig. 107 CB section piles, totaling 5684 lineal feet, were driven to penetrations ranging from 42' 6" to 75'. The CB sections were furnished in 50', 55' and 60' lengths to be cut or spliced in the field as required. Piles were driven to resistances averaging ½" penetration under 100 blows of a 9-B2 McKiernan Terry hammer operating between 120 and 140 blows per minute, thus indicating an average safe carrying capacity of 65 tons per pile. • Carnegie engineers would like to discuss this important subject with you . . . to show you significant facts and figures.

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BRIDGE OVER BLACK RIVER
at Hendrickson,
Butler County, MISSOURI.
Designed by
MISSOURI State Highway Dept.
General Contractors:
Service Construction Company,
Poplar Bluff, MISSOURI.
Structural Steel Fabricators:
Stupp Bros. Bridge and Iron Co.,
St. Louis, MISSOURI.

US STEEL

CARNEGIE STEEL COMPANY • PITTSBURGH

• • • Subsidiary of United States Steel Corporation • • •

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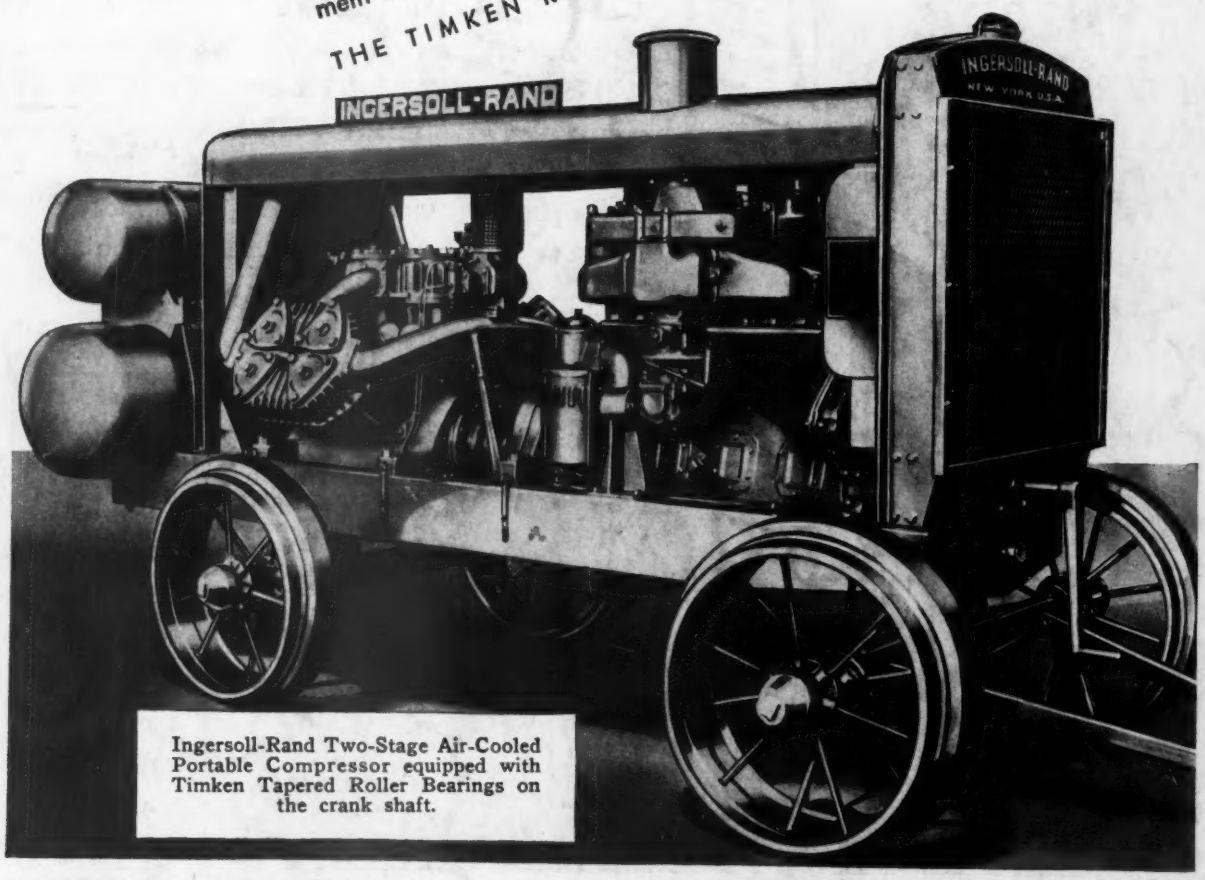
Smoothing the Pathway of POWER

Timken Tapered Roller Bearings enable power to do its work without waste in modern construction machinery by removing friction from its path.

Smoothing the pathway of power is a Timken advantage only exceeded in importance by Timkens' ability to carry radial-thrust loads and to hold moving parts in correct and constant alignment—two outstanding contributions to dependability, endurance and long life in equipment of every type.

TIMKEN Tapered Roller BEARING EQUIPPED

THE TIMKEN ROLLER BEARING CO., CANTON, OHIO



Ingersoll-Rand Two-Stage Air-Cooled Portable Compressor equipped with Timken Tapered Roller Bearings on the crank shaft.

TIMKEN *Tapered Roller* **BEARINGS**